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AMERICAN ALPINE JOURNAL

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THE
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The price of the current *Journal* is $2.00 per copy.

To our members who died in the service of their country, this number is respectfully dedicated:

Lt. W. S. GIFFORD, JR., U.S.N.R.
Pacific 1944

1st Lt. JOHN A. MCCOWN II, A.U.S.
Italy 1945

Major NORMAN R. STREATFEILD, R.A. (British Army)
Dunkirk 1940

During World War II an amazingly high percentage of the members of the American Alpine Club were actively engaged in the Armed Forces, while most of the other members shared wartime civil and administrative responsibilities connected with the nation's military effort. If accounts of all these wartime experiences could be gathered into one volume, the collection would be singularly impressive, but as such an accumulation is not practical, the Club has wished to record at least a cross-section of members' wartime activities involving either mountains or use of a background of mountain knowledge. This special number, brief as it is, with articles by less than a dozen men, is meant to represent not merely those whose names appear as contributors, but all members of the American Alpine Club who gave wartime service to their country.

R. H. B.
D. A. R., Jr.

NOTES ON CONTRIBUTORS

Charles S. Houston: Dr. Houston, well known to *American Alpine Journal* readers for his part in expeditions to Mts. Foraker, Nanda Devi and K2, was until recently Lieutenant-Commander Houston, U.S.N.R. During the war a flight surgeon in charge of various aspects of physiological research at the U. S. Navy Research Laboratory at Pensacola, Florida, he directed the Navy's "Operation Everest" and other pioneer experiments in tracing the effects of altitude on the blood.

Albert H. Jackman: Lt. Col. Jackman, long an advocate of mountain troop training, served with the 10th Mountain Division in Italy. Previously he had been the War Department observer on the Wood Yukon Expedition (1941) and the Army Ground Forces observer on the U. S. Army Alaskan Test Expedition to Mt. McKinley in 1942. In 1945-46 he served as observer on "Operation Muskox" in Arctic Canada.

Hugh W. Evans: Sgt. Evans, a graduate of Phillips Exeter Academy and currently a student at the Colorado School of Mines, served with the 85th Infantry Regiment of the 10th Mountain Division. He was decorated with the Silver Star for gallantry in action during the engagement he here describes.

Wilson P. Ware: Capt. Wilson Ware, Yale graduate, served as intelligence officer of the 1st Battalion, 86th Infantry, 10th Mountain Division, and took considerable part in planning the action of his regiment when it attacked Riva Ridge. Subsequently he was severely wounded and spent many months in hospital.

E. R. Gibson: Major Gibson, well known Canadian mountaineer, was the Canadian Army observer on the U. S. Army Alaskan Test Expedition, and later had major responsibility in the training of the Lovat Scouts in the Jasper Area. The great success of the Lovat Scouts some months later in breaking the Gothic Line in Italy and operating with great skill in the snowy Apennines is tribute to their Canadian winter training.

William P. House: This well known American climber served as a civilian with the Quartermaster General's Office, U. S. Army, dur-

ing the war, with tours of duty in Iceland, Greenland, and Arctic Canada. Being charged with the development of equipment for mountain troops, he performed his duties admirably, despite difficulties which he estimates lightly in his article. Recently he was the Army Service Forces observer on "Operation Muskox."

Bradford Washburn: The director of the New England Museum of Natural History served throughout much of the war as Special Assistant to the Chief, Army Air Forces Personal Equipment Laboratory, Wright Field. As such he was largely responsible for the development of the present issue excellent cold weather clothing for air crews operating at sub-zero temperatures. Casualties from frostbite during air operations made his work of utmost importance.

Weldon F. Heald: During the war the issue of clothing to U. S. troops was changed from a hit-or-miss system to a scientific arrangement of climate zones based on maps prepared by Major Heald. The advantages of climatological topography to civilian mountaineers and travelers as well as to the military will be seen by reading his article.

H. Adams Carter: As Adams Carter shows in his article, he began intelligence work on mountain troop problems early in 1941 and continued on the broader phases of this problem throughout the war. In 1945 he visited the German General Staff and the Japanese General Staff on special intelligence surveys for the Quartermaster General and the Chief of Intelligence, War Department General Staff. He is an authority on mountain troop operations.

J. Monroe Thorington: Dr. Thorington, the retiring editor of the *American Alpine Journal* and honorary member of the Alpine Club of London and the Alpine Club of Canada, needs no introduction to our readers.

Robert H. Bates: After more than four years in the U. S. Army, Lt. Col. Bates now shares editing the *American Alpine Journal* with Lt. David A. Robertson, Jr., who during the war served in the U. S. Naval Reserve.

THE
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VOLUME VI 1946 NUMBER 2

29,000 Feet

CHARLES S. HOUSTON

UNTIL a man actually stands on the summit and returns to tell about it, no one will know for certain that Everest can be climbed. But ignoring the technical climbing problems, one can speculate on the physiology involved and perhaps reach certain conclusions.

The war has made high altitude flight a commonplace. Ten or fifteen years ago 30,000 ft. was a remote and seldom attained height; today tens of thousands of military plane crews have flown even higher. Before the war there were perhaps a dozen steel altitude chambers in the entire country, while today hundreds of them are in constant use. All military flying personnel are trained for altitude flight by at least one simulated "flight" in these chambers to altitudes of 30,000 ft. and higher.

It is not surprising, in view of this extensive altitude experience, to find that our knowledge of the body's response to altitude has increased enormously. Not that we have discovered many new facts which Paul Bert, Barcroft and others did not know thirty or fifty years ago—we have merely polished up, refined, and learned to understand them better. Having spent the past four years in altitude training and research, I should like to try to apply some of these facts to climbing.

When the military pilot takes his altitude training "flight" in an altitude chamber, he may be allowed to remove his oxygen mask at 30,000 ft. or thereabouts. Within a few seconds he begins to fumble over simple tasks, becomes ludicrously and pathetically "drunk" and in less than two minutes loses consciousness. After two or three breaths of oxygen he has recovered completely, none the worse but much the wiser. The higher the altitude, of course, the quicker his collapse, but even as low as 18,000 ft. his condition

is far worse than at sea level. His nails are blue from lack of oxygen, and he feels sleepy, dizzy, perhaps hilarious. Even simple problems baffle and irritate him, and his judgment is poor, his emotions unstable. He is certainly far different from the acclimatized mountaineer who feels little effect as high as 23,000 ft.

The difference is, of course, due to acclimatization—that delicate adjustment of the body to oxygen lack. Most climbers who reach altitude slowly, working as they climb, are eventually able to spend weeks above 20,000 ft. and perform strenuous physical work. On the other hand, the unacclimatized man taken in a few minutes or hours to high altitude from sea level, has only minutes of rapidly failing consciousness as is dramatically shown in the following table:

DURATION OF CONSCIOUSNESS AT ALTITUDES

Altitude	*Acclimatized Man*	*Unacclimatized Man*
20,000 feet	weeks*	30 minutes
23,000 feet	weeks	15 minutes
25,000 feet	at least 10 days	8 minutes
26,000 feet	at least 5 days	7 minutes
27,000 feet	at least 3 days	5 minutes
28,000 feet	several hours	3 minutes
30,000 feet	?	1½ minutes

*Remember that these figures represent the time that climbers have actually spent at these altitudes *without* losing consciousness.

A complete discussion of the intricate processes of acclimatization is obviously beyond the scope of this paper, but among the many changes which occur, three may be mentioned briefly: The red blood cells increase in number, thereby providing more transportation to carry oxygen from lung to tissues. The volume of breathing is increased in an effort to bring more oxygen deep into the lungs and thence into the blood. And finally, the increased breathing, by "blowing off" carbon dioxide (carbonic acid gas), makes the blood more alkaline, which in turn increases the amount of oxygen which the blood can hold.

At present we have practical means to control only the second and third of these processes. Years ago physiologists knew that over-breathing would decrease the effects of oxygen lack. But if the over-breathing were too great and too much carbon dioxide were lost, the blood became so alkaline that dizziness, pins and

needles, and later muscle cramps resulted. Too much over-breathing might thus be worse than lack of oxygen.

Many recent studies have shown, however, that if the breathing is increased only slightly above what the body dictates, it is possible to stand safely between the Scylla of oxygen lack and the Charybdis of carbon dioxide lack. One of the truly dramatic demonstrations developed by aviation medicine is the difference between a man breathing normally and a man over-breathing slightly, at 25,000 ft. The former is incapacitated in five minutes and unconscious in less than ten, whereas the latter can move freely about the plane, perform his work, and remain in good condition for 45 minutes or longer.

It remains for some one to show us whether or not over-breathing will help the acclimatized mountaineer as much as it helps the unacclimatized pilot. In the case of the climber, acclimatization has already increased his breathing somewhat (though individuals differ considerably in this) and how much good he can obtain from further increase is speculative at best. But we do know that the pattern of breathing may be as important as the depth. Smooth rhythmic breathing, with inspiration about equal to expiration, at the rate of twelve to fifteen a minute probably gives the optimum oxygen supply to lungs and blood. Thus the scientists confirm what climbers and distance runners have known for years: smooth rhythmic breathing is of great benefit for optimum efforts.

Are there any methods for predicting or for improving the ability of a man to acclimatize? Aviation medicine has not helped us much in this respect, for acclimatization is really not practical for high altitude flying, in which the pilot ascends in a matter of minutes to heights which climbers reach in days or weeks. No tests have been developed recently which are better than that by which Harrop, in 1922, predicted which members of a Peruvian expedition would suffer from mountain sickness* and which would not. His method is a bit cumbersome and complicated, however, to apply to any man who is interested in learning his altitude potential. The ability to withstand lack of oxygen in an altitude chamber is no indication of acclimatizing ability, because this process requires weeks rather than minutes. And finally, none of the physical fitness

* It might be well to emphasize once again that *mountain sickness* occurs only at altitudes above 10,000 feet and is due to lack of oxygen. *Air sickness*, like sea sickness or car sickness, is due to rough motion and occurs at any altitude.

tests can be used with confidence, because fitness and ability to acclimatize are not necessarily linked. However, many small pieces of information, plus the Himalayan experiences of the past ten or fifteen years, indicate strongly that acclimatization is not much better in youth than it is in middle age. In fact many men under 21 withstand altitude less successfully than others over 28. There is good reason to believe that 22 to 35 is the optimum age for acclimatization, but that even up to 40 or 45, age *per se* does not decrease acclimatization ability.

The ability to tolerate altitude can, however, be improved by several means, and this may be of considerable help to Everest climbers. The controversy over the best foods for climbers which has raged for years and almost disrupted several expeditions seems to have been fairly conclusively settled recently. It has been shown experimentally that carbohydrates (sugars and starches) increase altitude tolerance by 1000 to 5000 ft.—in unacclimatized men. Theoretically the explanation for this effect should also apply to acclimatized men, though the demonstration remains to be made. The reasoning behind this effect is sound though too complex for this paper. Of course it is well known that carbohydrates are an excellent source of rapid energy. On the other hand it cannot be denied that men need proteins and fats to replenish constantly breaking down tissues, particularly during hard work.

An ideal arrangement would therefore appear to be a diet which is almost exclusively carbohydrate during the working day, when energy is needed and when any protection will be of help. In the evening, when the day's work is done and the need for oxygen less acute, proteins and fats can be the main part of the meal, to rebuild the body. Finally, quite apart from altitude, other considerations indicate that frequent small feedings (every two hours or so) are far more effective than fewer but larger meals. This is particularly helpful at altitude where the stomach, laboring under difficulties anyway, should not be over-burdened by large meals.

Vitamins on the whole have been oversold to the public. Though these mysterious compounds work wonders in certain specific deficiency diseases, they definitely do not "increase resistance" or "prevent colds" in the average man. For the climber, on a long expedition, they may, however, be of value, since his dietary is by necessity somewhat limited. Furthermore we do know that the vitamins B and C are indispensable catalysts in the use of oxygen by the tissues, and bits of evidence, as yet fragmentary, indicate that altitude toler-

ance may be improved by adding these vitamins to the diet. This means that the high altitude mountaineer, in addition to a normal quota of vitamins added to his diet, will probably benefit by larger doses of vitamin B complex and vitamin C.

What about other drugs? Years ago ammonium chloride was proposed, and used, to improve altitude tolerance. The rationale behind its use was logical, but the effects were disappointing in most cases. Bicarbonate of soda, suggested for entirely different reasons, is probably no better. No new "secret" drugs studied during the war have been revealed nor is it likely that any will be found which significantly raise man's ceiling.

In any discussion of the 28,000 and 29,000 ft. peaks the use of oxygen is inevitably brought up. In aviation, the pilot knows that life above 20,000 ft. is impossible for more than a few minutes unless he breathes oxygen. To the flight surgeon dealing with aviation problems, it seems incredible that oxygen should not be a *sine qua non* on any major peak. Even in acclimatized men, he argues, oxygen should give an added lift, an extra source of energy which might get the climber to the top. Why then have several who used oxygen on Everest claimed that they obtained little if any benefit from it? Were their statements biased by the bulk and discomfort of the apparatus then available? Or did the oxygen, in fact, fail to relieve their worst difficulty—the dreadful shortness of breath which resulted from the slightest exertion?

Lack of oxygen itself exerts a relatively weak influence on breathing. A man may lose consciousness and even die without being anywhere near as short of breath as a distance runner. Breathing is largely controlled by the balance between carbon dioxide and base in the blood. During exercise, large amounts of carbon dioxide, and other acids, are formed which must be neutralized by the blood or blown off through the lungs by deeper faster breathing. After hard work, therefore, we pant to blow off carbon dioxide rather than to obtain more oxygen. As mentioned above, one of the changes which takes place in acclimatization is a loss of carbon dioxide which, over a period of days and weeks, is balanced by a loss of base from the blood in order to maintain the proper reaction, though at a lower level. The net result is that there is a smaller reservoir of base available to neutralize the acids formed during exercise; these acids (particularly carbon dioxide) change the reaction of the blood and cause far more panting than they would were the normal amount of base present in the blood.

Acclimatization, therefore, actually is responsible for our breathlessness at altitude. In fact if the blood contained as little base at sea level as it does at, say 20,000 ft., in acclimatized man, the slightest exertion would cause severe breathlessness just as it does at altitude. However, this very breathlessness may keep the climber from "committing suicide" by exerting himself too far beyond the supply of oxygen available to him.

This is probably the best available explanation of the failure of oxygen to benefit the acclimatized man, at least to any great extent. Differences from individual to individual may explain why some men did notice some help from oxygen, though most did not. We have the anomalous situation, therefore, in which an unacclimatized man fresh from sea level and provided with a full supply of oxygen will far outclass a well acclimatized climber *with or without oxygen.*

In this air age one cannot resist speculating about the possibility of dropping a climber at base camp with a full oxygen supply. This man could climb at least at the Alpine rate of 1000 ft. per hour and descend at least twice as fast. Allowing seven days to reach 29,000 ft. and return, he would require 168 hours of *continuous* oxygen supply. He would be forced to breathe oxygen for every minute of the nights and days, otherwise he would lose consciousness like the pilots in the altitude chamber. Using any of a number of excellent military oxygen assemblies, his supply of oxygen, plus equipment, would weigh between 400 and 600 pounds, depending on the type used, the man's size, and his physical condition. Yes, it could be done, with elaborate preparations, detailed supply and transport arrangements—and extraordinary luck. The risk would be tremendous, for failure of his oxygen supply for an hour or less at higher altitudes would cost our climber his life.

Can men reach 29,000 ft. (or higher) without oxygen? Until it is actually done the answer will be doubtful at best. But by the best calculations which we know how to make at the present time, we can say that 29,000 ft. is only imperceptibly worse than 28,000 ft. On paper at any rate man can climb to 29,000 ft. and perhaps higher. He will need magnificent physical condition and climbing ability. He must have sound judgment and great perseverance and courage. His food, his creature comforts and his climbing stages must be elaborately planned. He will probably be as well off without oxygen as with it.

One day a man will do it.

The Tenth Mountain Division

A Successful Experiment

ALBERT H. JACKMAN

THE 10th Mt. Division was a good division, but many others with inferior training and equipment suffered more casualties, fought more campaigns, and killed or captured more Germans. Logically, then, the training and equipping of mountain troops hardly seems to be worth while. Infantry divisions without special training certainly did a wonderful job in Italy and broke the back of enemy resistance there before the 10th Mountain Division ever landed. Then, why all the fuss? Were the time and money spent on mountain and winter training justified? Yes, because in the short time our mountain troops were in combat in Italy they made an impressive record of offensive warfare, despite operations in exceedingly rough and mountainous terrain.

At the beginning of World War II certain officers in the War Department recognized the fact that troops require specialized training to operate successfully under conditions of snow and extreme cold. As a result, early in 1940, Lt. Col. Nelson M. Walker and Lt. Col. Charles E. Hurdis[1] were given the task of exploring the possibilities of ski troops.

Almost immediately it was apparent that winter operations were impossible without suitable clothing and equipment, and equally obvious that suitable items were not available in the Quartermaster General's warehouses. In 1940 War Department supply agencies were overwhelmed by the basic problem of feeding and equipping the new citizen army. These imperative needs, and the failure of the Quartermaster Corps to appreciate the close relationship between proper clothing and equipment and successful winter training operations, prevented the supply of necessary winter items through normal channels of supply during that winter. Consequently winter training directives in 1940-41 specified the purchase of civilian items

[1] To these two officers great credit is due for their part in organizing the first mountain regiment and in encouraging the War Department to continue mountain training in the face of severe criticisms. Both men were given other duties during the middle days of the war, and were unable to continue to give direct aid to mountain training. Later Nelson Walker (then Brig. Gen.) was killed by a German machine gun in France. In him the mountains and all lovers of the mountains lost a true friend. Brig. Gen. Hurdis later served with distinction against the Japanese in the Philippines.

of equipment for very small detachments from units stationed in or near snow country. Of these the Old Forge Ski Patrol from the 44th Division, the 15th Infantry Ski Patrol from the 3rd Division, and the Winter Warfare Training Board project at Camp McCoy, Wisconsin, were the most successful.

The terrain of Old Forge, New York; Mt. Rainier, Washington; and Camp McCoy, Wisconsin, had an influence upon the final recommendations of each detachment with respect to certain types of equipment, such as snowshoes, ski climbers, and hand-drawn sleds, but all agreed that suitable equipment and proper training in the use of that equipment were prerequisites for all successful cold weather operations. Thus far very little had been learned concerning training, but equipment needs and deficiencies were coming into sharp focus. Already equipment for the winter of 1941-42 was coming off the production lines, and already much of it was obsolete, for in 1941-42 training plans would not be modified because of equipment deficiencies as had been done the previous winter.

During the summer of 1941 the writer was detailed as an observer with the Wood Yukon Expedition, which was operating in the St. Elias Range, YT, Canada. This was the first official visit of a member of the Armed Forces during World War II to observe the problems of true alpine terrain. At this time equipment testing was less important, and training problems were assuming greater and greater importance to the War Department General Staff. Concepts of different training for mountain operations and for winter operations in flat terrain were being recognized for the first time.

Since a start in winter training had been made at Camp McCoy during 1940-41, the next step was to find out what could be done in mountain training. On 15 November 1941, the 1st Bn., 87th Inf. (Mtn.) was activated at Ft. Lewis, Washington. No training doctrine existed and none of the officers had ever served with mountain troops. The only veteran mountain trooper was one enlisted man who had fought with the Finns against the Russians in the winter of 1940, but all men were enthusiastic "mountain troopers."

The 1st Bn., 87th Inf. (Mtn.) trained at Paradise Valley, Mt. Rainier, Washington, from 15 February to 1 June 1942. Ski training was given and ski proficiency tests were taken in an attempt to determine the minimum proficiency required of a rifleman. In the

light of present experience, it is now realized that much time was wasted teaching skiing, but at that time nobody knew the answers, and the unit followed the directives given it. Alpine equipment was not then available in sufficient quantity for training.

The training on Mt. Rainier crystallized many more problems, and accordingly during the summer of 1942 "over snow" motor equipment was tested on the Columbia Icefields, summer mountain supply was tested at Aspen, Colorado; and the latest Quartermaster clothing and equipment was tested on Mt. McKinley. By the fall of 1942 this phase of experimentation was completed.

A test of the troops trained on Mt. Rainier by extended maneuvers between the 87th Infantry supported by pack artillery, and troops and artillery with standard training and equipment took place at the Hunter-Liggett Military Reservation in the fall of 1942. These were not alpine operations and it was apparent that the training on Mt. Rainier had not benefited the 87th except for the superior stamina of the individual soldier and his willingness to go anywhere across difficult terrain. This maneuver conclusively demonstrated that ski and alpine techniques are of little help in tree-covered mountains.

As mountain and winter training entered its third year, War Department thinking divided the problem into three parts and assigned it the following priorities:

1. Winter Training of Standard Infantry Divisions.
2. Low Mountain Training of Standard Infantry Divisions.
3. Alpine Training of Special Mountain Units.

The expression of this thinking during the next two years in terms of division training was as follows:

1. Winter training at Camp McCoy, Wisconsin, of the 2nd Infantry Division, Dec. 1942 to April 1943, and of the 76th Infantry Division, Nov. 1943 to Mar. 1944.

2. Low Mountain Training of the 45th and 36th Infantry Divisions in the Buena Vista, Va., Maneuver Area, Feb.-Apr. 1943.

3. Based upon the success of the 45th and 36th Infantry Divisions in Sicily, the West Virginia Maneuver Area was opened and a steady flow of units through this area was maintained from Aug. 1943 until May 1944.

4. Training of special mountain units stationed at Camp Carson, Colo., and at Camp Hale, Colo., Nov. 1942 to May 1944.

On 19 July, 1943, Nelson Walker's dream came true. The U. S. Army had a mountain division. Almost all of the divisional units had been in existence for some months. Many of the original officers and men had drifted into other and more attractive fields, but those who remained in the 10th Light Division (Mtn.) were impelled by one and only one desire, "To get ready to fight."

There were still many unanswered problems. Tactics were being learned. Supply was a problem, and the men at that time carried loads that no man in combat could carry, but progress was made each time the units took the field, and all training pointed towards the "D" Series.[2]

Even 18 months later, after severe combat in the Italian Apennines, mention of the "D" Series brought awe to the voices of the veterans. Cold, snow, refractory mules, sleepness nights, 14,000 ft. peaks, and hazing from the "brass" combined to produce a situation that batteries of German 88's and later actions could not make men forget. "It's not as bad as the 'D' Series," they later cried, and believed it. For the first time the division functioned as a unit. The XVI Corps sent umpires and the War Department watched closely through observers from all Arms and Services. At the final critique, Maj. Gen. Lloyd E. Jones, Division Commander, stated that never in the history of the U. S. Army had a division undergone such a rigorous training maneuver.

The War Department was now satisfied that it had a trained mountain unit capable of enduring the worst alpine weather, and not afraid to tackle any type of terrain. But could it fight in the flatlands? That is important too. Accordingly, July, 1944, found the mountaineers at Camp Swift, Texas, doing it all over again but without mountains. Texas sand and heat were worse than Colorado's snows, but the units learned to speed up their time and space calculations, and unlimited ammunition allowances improved their marksmanship. Here every man became POM qualified.[3] Maj. Gen. George P. Hayes took command and the division moved out.

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[2] Ground Force Training is progressive from the day a man enters a Replacement Training Center. The first stage is Individual Training, followed by Unit Training, then Combined Unit Training, and finally by the "D" Series (Divisional Maneuver Training). No "D" Series problems existed for a mountain division at any of the posts, camps, stations, or maneuver areas, but the XVI Corps, which was somewhat unfamiliar with the difficulties of mountain maneuvers in winter, drew heavily upon imagination and came up with a series that has become legendary.

[3] POM means "Prepared for Overseas Movement."

The Italian front had been stabilized along the crest of the Apennines in October and November, 1944. At all points from the Tyrrhenian Sea to the British lines near the Adriatic the enemy held higher ground, and at one place he held a large salient anchored on Mt. Belvedere. From Mt. Belvedere he had observation on Highway 64, one of the two main supply routes of the central Italian front. Until the use of Mt. Belvedere was denied German observers, no allied offensive up Highway 64 could be launched successfully.

The key to Mt. Belvedere was the Mancinello-Campiano (Riva) Ridge,[4] which in winter offered truly alpine terrain problems. From this buttress any unit or individual approaching Belvedere from the allied side was under the eyes of German observers. On 19 February, 1945, however, a reinforced battalion of the 86th Mt. Inf. scaled the Mancinello-Campiano Ridge, surprised the German garrison, and completed the first step toward reducing the salient. On 20 February the rest of the 10th Mountain Division jumped off against Mt. Belvedere. Initial objectives were secured by daylight and a week of counterattacks followed before the Division reduced the salient and straightened the line. By 7 March, 1945, the operation was completed.

This first offensive action of the first mountain division of the U. S. Army was significant. Other divisions had twice failed to take Mt. Belvedere. German prisoners later stated that they did not believe that troops could scale Campiano Ridge and arrive in condition to fight.

The loss of observation on Campiano Ridge now forced the Germans to support their counterattacks with unobserved artillery fire on the 10th Infantry's newly won Belvedere positions. The loss of Belvedere knocked out the last observation on this section of Highway 64, and made the salient untenable. From 7 March to 14 April the line had been straightened and preparations for the spring offensive had gone full speed ahead, so that on the jump-off day on the Castle d'Aiano-Riola Line, the division was battle wise, poised and confident. Seven days later the 10th Mt. Division was in the Po Valley, and on 23 April forward elements were across

[4] See *Italy: The Riva Ridge,* by 1st Lt. Wilson Ware; and *What's Behind That Battle Star,* by Staff Sgt. Hugh Evans, this issue. Troops identified this ridge differently, depending on the proximity of various villages to their assault positions, but it was generally known as the Mancinello-Campiano or Riva ridge.

the Po. Within another week all of Lake Garda and the adjacent country was under 10th Mt. Division control. Pack animals, pack equipment, and special alpine equipment were on their way forward. Preliminary steps had been taken and plans were nearing completion for an alpine campaign to break into the Nazi redoubt. Then the war ended in Italy.

Now, less than five years after Lt. Col. Walker wrote the first directives for the purchase of civilian equipment and the training of ski patrols, the 10th Mt. Division is history. Deactivation was completed 1 December, 1945. An idea had been tried, and a stepchild had finally become a first class combat outfit.

The war did not prove that standard U. S. infantry divisions are helpless in the mountains. Nor did it prove that armor was unnecessary in the Po Valley, but it did demonstrate that mountain trained troops can learn to fight easily and efficiently in mountainous terrain, and that given proper leadership they are just as effective in the flatlands.

Proper equipment and training are the Damon and Pythias of mountain operations. Quantities of special clothing and equipment were issued to untrained units in Italy, but men still had trenchfoot, frosted fingers, and restless nights until special training in the use of special winter equipment was given by competent instructors. In winter and low mountain operations, special organizations are less important. Time and again the war proved that properly equipped specially trained standard units performed better and came through with fewer casualties from weather, terrain and the enemy than other standard units which, without the special equipment and training, were fighting beside them.

I believe that special organizations are desirable in truly Alpine operations, although we have no U. S. combat experience on which to base such a belief. Had the end of the war not come just when it did, warfare in the Italian Alps would have tested the division even more sternly, and proved what trained mountain troops can do in warfare in big mountains. However, as the 10th Division pushed north from Riva[5] and was about to enter upon a truly Alpine campaign, the war fortunately ended and many lives were saved.

[5] Situated at the northwest corner of Lake Garda in northern Italy. Not to be confused with the Riva Ridge of Mt. Belvedere, which lies in the Apennines and south of the Po.

What's Behind that Battle Star

HUGH W. EVANS

All the glory, laud, and honor
May fall 'round our shining armor
That only rotting cloth doth be,
But this is not for what we fought.

THE individual stories that have had their source in our recent war are infinite. Every man and woman can recall at least one moment of fear, uncertainty, joy, or emotion that has been aroused because of some incident which occurred during the last six years. I am only one particle in this mass that has suffered and fought through a world war, yet I can recall many times when my emotions seemed too enormous for this particle to contain. Every time I see a battle star on a campaign ribbon I wonder what that particular star cost, what stories are behind that tiny piece of bronze on that kaleidoscopic ribbon. I wonder, because I know what that small piece of metal cost us. The story that follows is a partial description of what one bronze battle star meant to the men of Company "C" of the 85th Mountain Infantry Regiment. It is limited, unfortunately, to one individual's point of view and scope of action—in reality only an infinitesimal portion of the whole.

Around the latter half of February in 1945 our company started its long foot journey up toward the small Italian village at the foot of Mt. Belvedere, which later became known to us in the army vernacular as "Queercola." We had already had our introduction to battle through combat patrols and line duty on a quieter, more mountainous sector of the Italian battle line. We had been in Italy, however, less than thirty days. As we trudged up the snow-powdered road, the men were talking about home, experiences they had already had in Italy, and the numerous stories, both funny and grim, of their training at Camp Hale and Camp Swift. The talking did not last long, though, because the grade was steep for the loads we were carrying. Then, too, Jerry was out ahead somewhere, and noise was liable to mean a shelling. As the silence of the universe seemed to sink in our bodies, all that was left to tense the ear was the rhythmical monotonous thud . . . thud . . . thud of a platoon out of step. Our eyes followed the mammoth beams of

light focused from far down across the valley on the German positions on the prominent mountain ridges to our front. These lights were used to blind the Germans so that they could not observe what was going on in the valley below them. Our thoughts followed these lights.

Queercola turned out to be muddy and unpleasant even on this beautiful crisp moonlit night. It had the bad symptoms of intermittent shelling. We didn't have much time to look around before the company was quietly dispersed into the various houses and barns throughout the village. Soon all that one could hear was the very faint metallic clicking of machine guns going in place. Our mission, we had been told, was to hold this forward outpost on the 5th Army line and to do a great deal of patrol work along our sector to feel out the German lines for a division attack on Mt. Belvedere and the surrounding ridges. Three attempts had already been made to take this key position, but all had failed for different unpredictable reasons. Now it was our turn. It was our first major battle. It was to be our birth as a combat division.

We spent the next five days mostly waiting and thinking. We had made intensive plans for a thorough patrolling program, so as to find any weaknesses in the German lines, but orders soon came from higher up that no patrol work was to be done. A blind attack was to be made because it was believed better to surprise the Germans rather than, by extensive patrol activity, to give away the fact that something was going to happen. Because of our company commander's initiative, however, we did have some opportunity to feel out parts of the Jerry line. A small group went up through the Brazilian sector to our right and were able to reach a point at the edge of our battalion's objective without receiving fire. This fact gave us all quite a bit of encouragement.

On the fifth day of our occupation of Queercola we were given the order to pull out that night and to move to an appointed bivouac area just under the noses of the Jerries who held our objective. Our movement was made very quickly and successfully early that evening, and most of the men were now prepared for the worst. Immediately after we had pulled out of Queercola, another unit moved in, but because they made a little too much noise, the village was shelled. This incident made us all the more quiet. The next day we spent improving the foxholes we had dug the night before, separating the equipment we were going to carry with us from that

which we were going to leave behind, cleaning our guns, getting our "K" rations, and receiving last minute orders and plans. I was sent back to rear supply depot to pick up some white phosphorus grenades. That trip back was like a propaganda movie shown for the purpose of building up a unit's morale. From the moment I left our area until I reached the supply depot, which was about two miles behind our positions, I passed field after field of ammunition. This sign of massive preparation gave me a feeling of the support we were to get. It made me proud and fearful to realize that we were to be at the very head of this tremendous supply of munitions and equipment. When I returned, I told the men about what I had seen. Encouragement began to boom in their eyes. They talked for a while about what we would do to those damned Jerries, but this talk soon stopped because reality was staring us straight between the eyes.

All of us, except those on guard, rolled into our blankets and snuggled together in our holes as soon as it became dark that night. It was cold, but our bodies shivered from more than the physical cold. Not many slept or even rested, for at midnight we were to start our move toward our battalion "I. P."

Our attack was to begin a couple of hours before dawn. In other words, we were to carry out a night attack on a division scale, which means superb organization and timing on the part of the higher-ups. A night attack also requires trained troops because men must not fire their rifles, must keep quiet, and need skill in keeping contact. We had been keyed to this high pitch in all our training. We were ready.

I saw our platoon runner dodging through the low brush and trees towards our headquarters. I got up and rolled my blankets and stuffed them in my rucksack. Before twenty minutes had passed, we were all loaded and on the move. We carried all our equipment for a short distance, and then deposited it in platoon piles along a small mountain trail where the Alpinis and their mules could pick it up and bring it on to us after the push.

As we turned off the small road and began our move straight up the mountain, nobody spoke. Nobody wanted to speak. Our minds were too filled with thoughts and fears. We were dressed in our wools and combat boots, and carrying in our mountain jackets or hanging from our belts, grenades, extra ammunition, and two meals of "K" rations. I had for a weapon a machine

pistol, but there were only two of these in the platoon. Most of the men were carrying "M 1" rifles. We had also within easy grasp our shovels and bayonets. Our company was in the lead and was stretched out in a long thin line with a good five yards between men. There was a small moon in the sky that gave us enough light to keep this distance. However, we never saw more than one man ahead and felt quite alone. Half the battalion was behind us, and the other half was moving up a couple of hundred yards over to our right. Everything was to be done on an intricate time schedule.

We moved in this manner for approximately half an hour, when suddenly on our left a German "burp" gun[1] opened up. Before we could think, we were on the ground and frightened. That was the first fire, and as yet we could not judge where it had come from or how close it was. The fire stopped and I wondered why we did not start to move. I could just see the man in front of me lying in the shadow of a tree. Soon I sensed that the line must have gone on, so I moved up to this man and discovered that it had. For a second he had frozen, and the column had moved out. Now he had lost sight of the man in front of him, and he was afraid to go on. Anger overpowered me because I realized contact had been broken. That meant only a small part of our company was up ahead alone, and the greater part of the battalion was behind us waiting to be led up. I moved ahead of this man on a half-run, and he followed. Going straight ahead for a short distance, I came upon another man lying on the ground. Falling beside him, I asked in a whisper if he had contact with the man in front of him. He nodded his head, and my heart slid back in its place. The gun on our left kept firing, and soon a small fire fight began off in the dark, but by this time we had become accustomed to the sounds and kept on moving.

Our movement became surer and more steady as we climbed up the steep ridge towards its top. When we had reached a point about half way to our objective and nothing serious had happened, our confidence began to flow again. That was the last confidence we were to know. From then on, we would know what an attack meant.

A tiny whir suddenly rose to a scream and ended in an explosion. We all fell to the ground. They were shelling us! Had they

[1] Machine pistol.

heard us? . . . Did they know where we were? Before we could answer these questions, shells began landing all over the side of the ridge we were ascending. It soon became apparent that the Germans were laying in patterns of artillery fire. The shells would climb up one draw and then "ladder" down a ridge. They didn't know where we were, but they were shelling all possible routes of approach to their positions. All we could do was to keep moving forward, and hope. Soon they had bracketed in on both sides of us. Our area had to be next.

Shells started to land below us. I knew that they had to be landing among the men of the company behind us. The barrage worked up the hill rapidly. I heard the unmistakable sound of a shell that was destined to land very close. I hit the ground, and the muscles in my buttocks and the rest of my body were so tight that I thought they would pull apart. Shells fell in and around us; and dirt, rocks, powder, and smoke filled the air while shrapnel whined over us. I kept telling myself to relax, that my chances were pretty good. I kept asking God only to let me live. A shell burst right in front of me. I was sure it had killed the man where it burst. I ran to him. He was unable to move and had his fingers dug into the hard frozen ground. He wasn't hit by any fragments but was paralyzed from the shock of the explosion and his fear.

When the shelling moved off momentarily, word was passed up the line that the shelling had wiped out a squad in the third platoon —two dead, six or eight wounded. One could hear the plaintive calls for "medic" from different points around in the darkness. We were at the fringe of the woods just about two hundred yards below the enemy lines. Tracers from the Jerry automatic weapons were now streaking and snapping over our heads like weird rocket-propelled fireflies. Shells dropped in among us every minute or so. The company commander and the platoon leaders got together near where I was lying to plan the final phase of the attack. I hugged the ground as closely as I could, shivering from cold and excitement, and trying to relax.

Within what was actually only a few minutes, but what seemed like a couple of hours, the platoon leaders had received their orders and had returned to have them carried out. The moon had set now and, except for the intermittent flares of light caused by shell bursts, it was pitch black. Our platoon was told to keep contact, and that we were to move straight ahead. In the confusion caused

by the darkness, casualties, and platoons criss-crossing through each other, again the unit of men in front of me lost contact. Knowing the orders, I headed straight up the bare slope, running and hitting the ground whenever I heard a shell coming. What was left of the platoon followed. Going only a little way, I passed a wounded man from the platoon; he pointed out to me on the skyline the silhouetted hill the platoon had headed for. Advancing another sixty yards, I ran into our platoon leader, who gave me hurried orders and went off into the dark. I joined a group of men on the reverse slope of a steep rise and gave my men the order to dig in with the men already there. Night was about over, and I knew that we were going to have to act quickly if we were to hold our position, then go on to take our objective.

After a short talk with one of the sergeants, I learned more about the situation. Up to this time, I had been bringing up the rear of the platoon. When I believed I knew what was happening, I returned to the fringe of the woods on a dead run to look for the company commander. Somehow, now that responsibility was placed on my shoulders, and there was something to be done, fear left me for a while. I found our company commander, and both of us went back up the slope, running, crawling, and hitting the ground until he could see where our platoon was. Then he left to give some orders to another unit. In those last thirty minutes or so before dawn, while the sky was beginning to lost its blackness, everything began to move. Organization began to revive. I moved up and down the slope two more times during that period and helped to point out routes of approach for our battalion's heavy thirty-caliber machine guns which were moving up onto our positions, and collected a few more men. By sunrise, our positions were pretty well held. Our mixed company was gathered in two separate spots to the front and to the right of the last Jerry stronghold on our objective. From where I was I could just see the heavy thirties being put up about a hundred and fifty yards to my right on the crest of a knoll at the top of the ridge. Within a few minutes these guns were putting a deadly accurate and steady fire on this last German position. I left my group of men and headed for these guns, running in the defiladed areas and crawling where there were gaps in the protecting rise.

Upon reaching the vicinity of the guns, I came upon Bob, my platoon sergeant, who had been riddled through the chest by a

machine-gun burst. He was still living. Another man was kneeling beside him holding his yellowish-green hand. Seeing that he had a sucking wound, and not being able to think of anything but to put an air-tight bandage on the wound, I ripped the back out of the pile jacket of the kneeling soldier and began to make such a bandage. Before I had finished, I looked up at Bob's eyes and saw that he had died. I felt his pulse to be sure, and all the kneeling soldier said was: "He begged God to let him live. He kept saying: 'Oh God. Please not now. Please not now!' " Bob was twenty. I got up and left, my eyes filled with tears of anger. He was the first person I had seen die.

I returned to my men after locating through the sights of the machine guns the exact German positions. As I was peering over the top of the rise, I saw two men who had been trapped under this last enemy position start to crawl in front of it. I realized that the Jerries were not manning that gun at that moment, so I got up and ran across the dip and slight rise to the two men. I called when I got up, and some men followed. We received no fire. When I reached the crawling men, we heaved grenades at the points where we thought the Jerries were. All of us were so angry we didn't speak. Finally I jumped over the last little rise and dropped in the first of the German positions, landing on two dead Germans.

For the next ten minutes I just kept moving, throwing grenades and firing my machine pistol. In that time all of us cleared out this last enemy position. The last Germans, who got up and yelled *kamerad,* I held with an empty gun. The toll in Germans was about eight dead and twenty captured. Our objective was taken.

When Company "A" had moved on beyond this position and had started their long and costly job of knocking out the Jerries' flank, I went back over the ridge to rejoin my company. I met one GI going in the same direction, and as we passed a dead American soldier who had had the top of his head blown off, he said: "That's my brother," and just kept on walking. The cost had been very heavy.

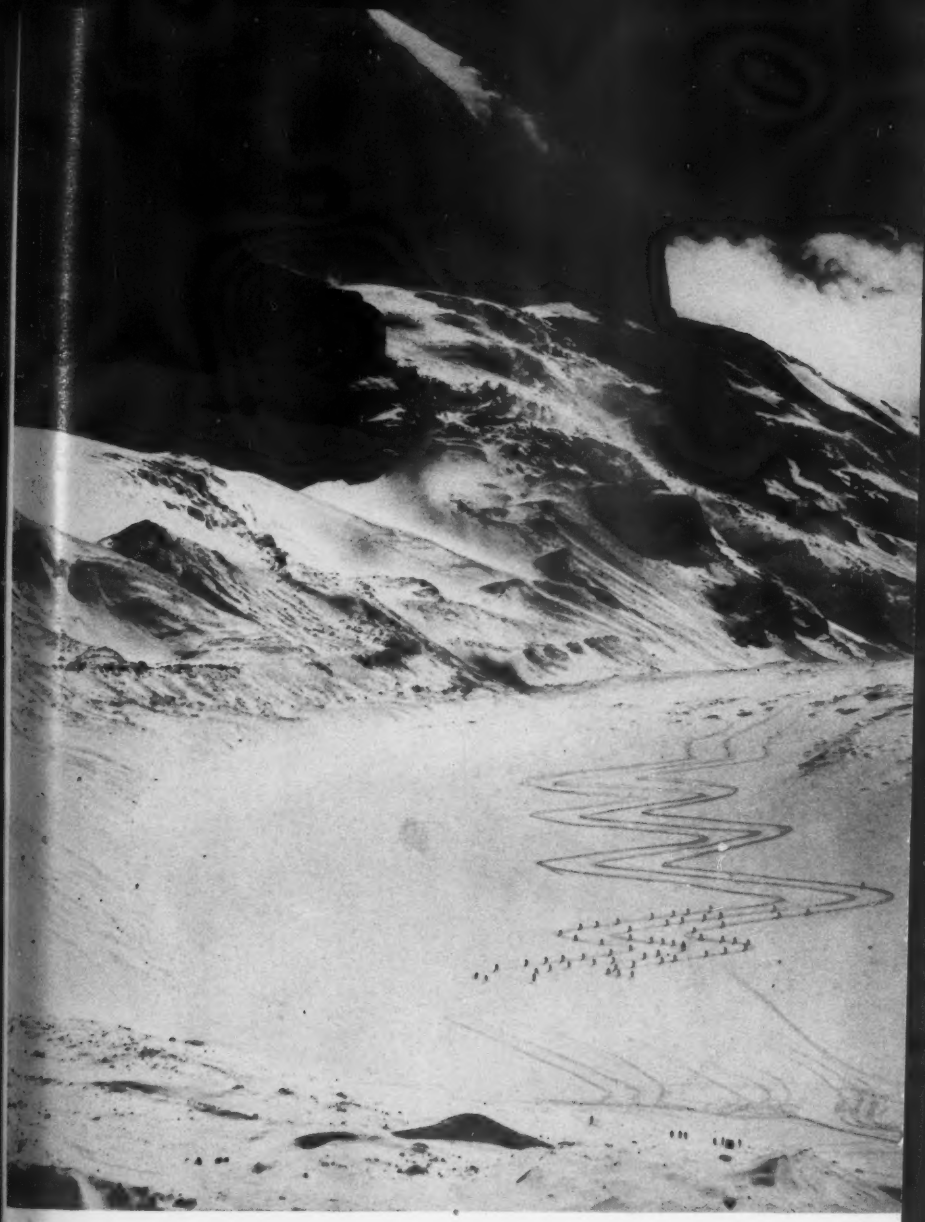
When I found the second platoon, the platoon leader told me that I was in charge. Everyone was digging in, and I went out to locate anyone else I could find from our platoon. I passed the company commander, who was sitting up on the ground wrapped in a coat. He had had both legs badly broken by a mine explosion, yet when he saw me he asked how we had done. When I had answered

saying that we had knocked the —— Germans off the mountain, he smiled and said: "Nice going!" I turned my head away and walked off weeping.

After finding two men, I returned to the platoon and helped dig in with my platoon leader. The shelling started again. As 88's screamed over our heads and headed for the valley below us, we all crammed ourselves into our holes and our minds were completely blank. It was noon.

I said in the beginning I would write a brief story about what one bronze battle star meant to me. I can not. It is a matter of record, however, that for this action and for similar combat during the next six weeks, each man of the 85th Mountain Infantry Regiment received his first bronze battle star.

Perhaps now you can understand why my eyes always turn to count the battle stars worn by an infantryman.

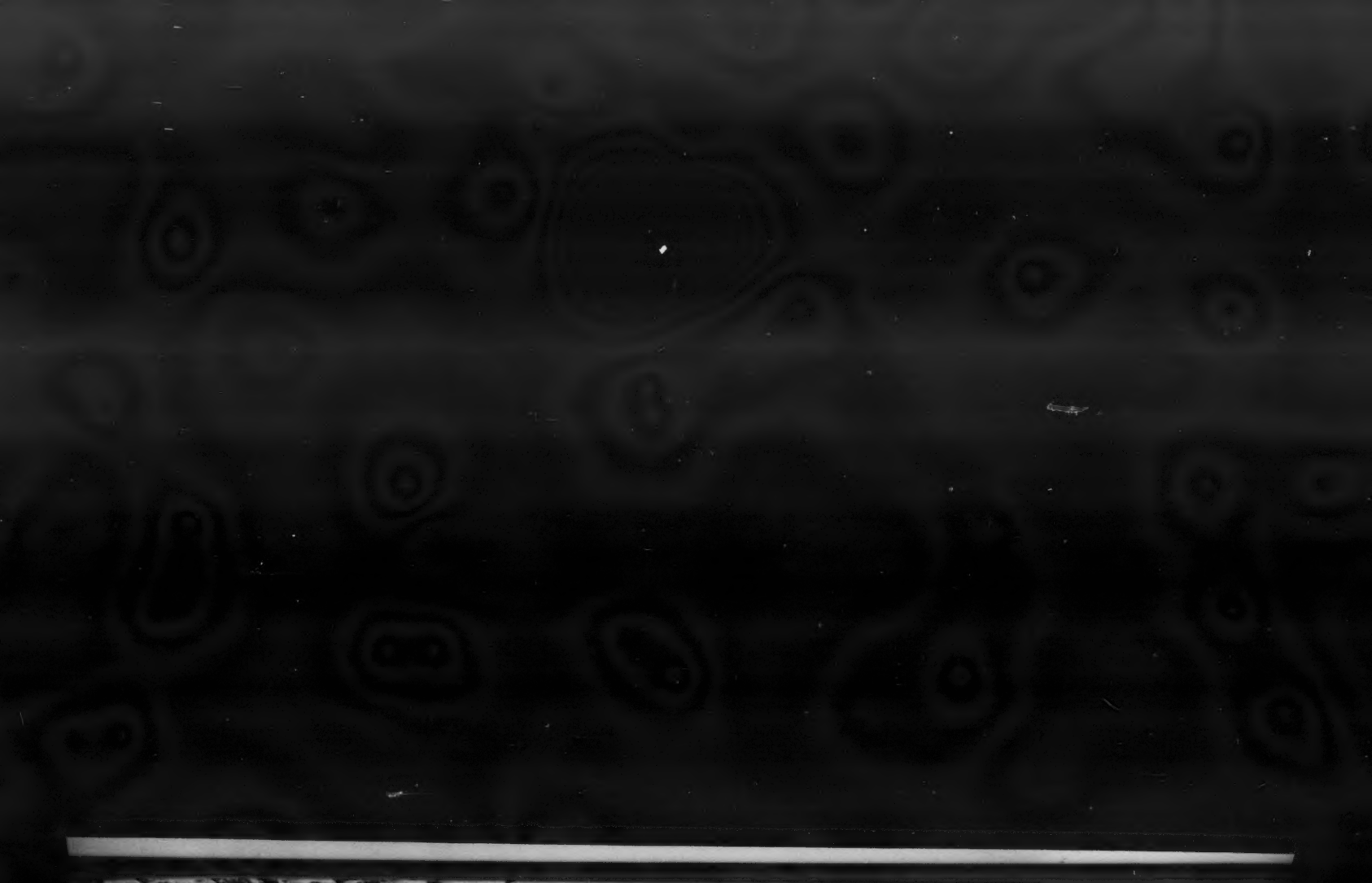


SKIING UNDER CONTROL ON THE TONGUE OF THE ATHABASKA GLACIER
Photo, National Film Board of Canada

TWO NORSEMAN PLANES RECONNOITERING IN THE MT. ROBSON REGION

The left hand skyline ridge is the N. W. ridge. The ice pinnacle formation which prevents access to the summit from this side is well shown

Photo, National Film Board of Canada



Training Mountain Troops in the Canadian Rockies

Rex Gibson

AT the urgent request of the editor I am addressing myself for the third time to the task of writing an account of a most interesting military experiment, namely, the training of the Lovat Scouts of the British Army in the technique of travel and fighting among high mountains. I was assigned the duty of compiling the official report, which is on file in Ottawa, and also wrote a lengthy article for the *Journal* of the Alpine Club of Canada. It is therefore my intention in this paper to write a more concise account of these operations.

When the global aspect of this war became apparent, it was obvious that some at least of the campaigns would have to be fought among high mountains, and keen mountaineers in the U. S. A., Great Britain and Canada soon realized that the armed forces of the Allied Nations were almost totally unprepared for such a type of warfare. It was largely due to the initiative and drive of this small body of experienced mountaineers that official lack of knowledge and indifference in high quarters was overcome, and that plans were made for training specially selected troops to operate and fight in high mountain country.

If we consider how well prepared our enemies were with a number of highly trained divisions of mountain troops—Jaegers, Alpini, Bersaglieri and others—it is not to be wondered at that the allied armies suffered a number of serious defeats in mountainous terrain, where their infantry were pitted against mountain troops. The disastrous campaigns in Norway and Greece were sad examples of this.

The ease with which a line defended by high mountains can be held has been demonstrated time and again in this war, and also that the assault and capture of such a line can only be successfully carried out by mountain troops. It was particularly interesting to read in the A. A. C. circular letter of 9th April, 1945, of the successful operations carried out by the men of the 10th Mountain Division, U. S. Army in the Apennines. The British troops which

we trained in Jasper were also in action in the same general mountain area in Italy.

When it was decided in the fall of 1943 to train a battalion of the British Army in the Canadian Rockies, we had little difficulty in finding suitable training grounds, and the Jasper-Columbia Icefields area was selected. Accommodation presented only a minor problem. The major difficulty was to provide a suitable body of competent instructors. Most of the really good young skiers from Jasper and Banff were already in the Royal Canadian Airforce or the Royal Canadian Navy and their services could not be obtained. In any case well trained mountaineers were practically non-existent, and we had perforce to do the best we could with the available material. It was found necessary to conduct a three weeks' Pilot course for the Canadian instructors and I arranged this for the period November 15th-December 8th, 1943. We were fortunate in having the assistance of a most eminent mountaineer, none other than Squadron Leader Frank Smythe, R. A. F. (later Lt. Col. Smythe), veteran of three Mount Everest expeditions, author of many mountain books and photographer extraordinary. Frank was appointed chief instructor and it was my privilege to introduce him to the Canadian Rockies during a preliminary reconnaissance, which we carried out in the Columbia Icefield area in October, 1943. During the course of this survey we climbed Wilcox Peak (9463 ft.), Sunwapta Peak (10,875 ft.), and Mt. Athabaska (11,542 ft.). Given fine weather major peaks can be climbed with enjoyment as late in the year as October, but it must be remembered that snow-covered glaciers present special hazards in the fall, as usually enough snow has fallen to hide narrow crevasses effectually, while the bridges thus formed have not enough strength to support a climber's weight. This I found out to my cost on a trip up to the Columbia Icefield via the Athabaska Glacier on October 21st, when I fell into a hidden crevasse and dangled on the rope for fifteen minutes before Frank and Corporal Black succeeded in extricating me. A careful inspection of the spot failed to reveal any surface indications of the crevasse and the place where I broke through had borne the weight of the whole party on the way up. Constant and unremitting probing is the only method by which such hidden traps can be discovered.

During the three weeks' pilot course we did our best to teach skiers to mountaineer and mountain climbers to ski—the latter

proving the more difficult task. Thanks to a spell of unseasonably warm weather we made rapid and satisfactory progress. We were able to weed out a few unsuitables and eventually build up a fine body of instructors, both officers and men, numbering eighty all told. Our aim was to have one instructor to every ten men. This was necessary as we had the formidable task ahead of us of teaching 800 men to ski in six weeks. The ski instruction *per se* was not required as part of the troops' military training in high mountain warfare, but it was forced upon us, as skiing was the only satisfactory means of getting around in the high country in mid-winter; for reasons best known to themselves the "powers that be" at the War Office had decided to carry out this training at this season.

When the main body of the Lovat Scouts arrived in Jasper on January 9th, 1944, we had everything ready for them and the training began in earnest. With 800 men in the battalion and 200 Canadian Army personnel in the Winter Training School, a considerable amount of accommodation was required. We took over all the staff quarters of Jasper Park Lodge, the Canadian National Railways' beautiful summer resort on the shores of Lac Beauvert. The golf clubhouse made an admirable officers' mess and from its windows we could watch the beginners learning kick-turns and snowplows on the snow-covered fairways of the golf course. Unfortunately the snow did not last long in Jasper itself and we were obliged to establish outlying camps even during the preliminary instruction period. Six such camps were set up at the following places: Mt. Edith Cavell Chalet, Chrome Lake (Tonquin Valley), Maligne Lake Chalet, Watchtower Valley, Snowbowl Valley, and Columbia Icefield Chalet. This last had been the venue for the Canadian instructors' Pilot course and with the addition of winterized tents had accommodation for 200 men.

On completion of the ski instruction period, which was carried out on a carefully prepared syllabus, a competition was held with teams entering from each squadron and points were aggregated for the championship by combining three events: 1. A slalom race over a difficult course with a 900-ft. difference in elevation. 2. A four-mile cross country race. 3. A military four-man patrol race, which included rifle shooting at targets at 200 yards range. In this event points were granted for good marksmanship. The competition was extremely keen and "D" squadron were the eventual winners. Most of the men in the Lovat Scouts were good marks-

men, as they had been recruited largely from the highland ghillies and deer-stalkers of the north of Scotland. Quite a number of men spoke Gaelic among themselves and the remainder had such a broad Scotch accent that one almost needed an interpreter. However, speaking generally, they were tough and used to the big hills and were of a most suitable type for mountain warfare.

Once the ski instruction was completed and a sufficient mastery of the hickory blades had been acquired to confer reasonable mobility on the troops in deep-snow country, the training swung over to more definite military operations, and after a period of troop (platoon) exercises more ambitious schemes were undertaken.

By using snow holes troops were able to camp in comparative comfort on the Columbia Icefield at elevations of 10,000 ft. during the coldest part of the winter. These snow holes or snow caves deserve a word of explanation. They are not igloos and do not call for any special skill in their construction. The snow hole is simply a cave dug down into the névé snow to a depth of about eight feet, leaving approximately 18 inches of head cover. Radiating from the central cave are recesses in which the occupants can place their sleeping bags. Insulation was provided by the U. S. Army fibre-filled waterproof mats, and with the Primus stove going temperatures were easily raised to 35° F. in spite of the high altitude. It took about two hours to dig a cave big enough to hold six men. When completed these caves have many advantages over the two-man mountain tent issued to mountain troops by the American Army. They are warmer, immune to the effects of wind, and no condensation of the occupants' breath occurs in them. After a night in the tent in extreme cold weather, one's frozen breath resembles a miniature snowstorm and in a short time sleeping-bags, tent walls, etc., all become wringing wet. Other advantages are that no tent has to be carried, and an unlimited water supply is readily available inside the shelter by the simple process of digging out a piece of the wall. The lower down the snow is taken the higher is the water content of the snow crystals.

During the course of the training a great deal of winter mountaineering was carried out and thanks to the excellent design and well tested quality of the U. S. Army ski clothing and equipment no serious cases of frostbite were recorded. Parties of troops made winter ascents of the following big peaks in the Icefield region: Mt. Columbia, 12,294 ft. (first winter ascent); Mt. Kitchener,

11,500 ft. (first winter ascent); Mt. Athabaska, 11,452 ft.; Snow Dome, 11,340 ft.; "Mt. Andromeda," 11,200 ft. (first winter ascent); Nigel Peak, 10,535 ft. (first winter ascent). The ascent of Columbia was completed on March 14th, 1944, by about thirty men led by Major Doug. Groff of Winnipeg, during the course of a three-day patrol on the Icefield, using snow holes as sleeping quarters.

In the Tonquin-Chrome Lake area winter ascents were made of McDonell Peak (10,700 ft.) and of several smaller peaks. Mt. Bennington (10,726 ft.), however, resolutely refused to be conquered, though climbing parties led by Captain Peacock, a member of the Alpine Club (London), made three attempts on it.

In the Maligne Lake region most of the training was carried out on the Bald Hills and the only major peak ascended was Mt. Charlton (10,554 ft.) on February 23rd. A party of four led by the writer made the ascent on skis (to the 9800-ft. level) and reached the summit in six and one-quarter hours from the lake shore. The U. S. Army amphibian snowmobile (known as the T 29 or Weasel) was used throughout the winter to keep the camps at Maligne, Watchtower, Snowbowl and Chrome Lake supplied. Trucks handled the supply to the camps at Mt. Edith Cavell and the Columbia Icefield. The Canadian Army packhorse train was also employed in packing supplies in to Chrome Lake and Snowbowl. It was found quite feasible to operate horses in three feet of snow once a good trail was broken by them.

The American Army and Air Corps were represented at Winter Training School by a number of officers and men including some first class ski instructors from Camp Hale. Major Walter A. Wood gave us the benefit of his unique experience in the aerial delivery of supplies in high mountain country. Major Innes Taylor and Mr. Belmore Browne both made a valuable contribution by their extensive knowledge of the far north and cold weather conditions generally. Belmore Browne's inimitable drawings illustrating the finer points of mountain technique, how to use and how not to use iceaxe, rope, crampons, etc., were real works of art, and will, I hope, be preserved for posterity in some future Manual of Military Mountaineering. Lieutenant Ben Thompson, with Sergeants Behnke, Coyte, Luginbuhl, Stoen and Walther, all of the U. S. Mountain Infantry, rendered valuable assistance. All were very favorably impressed with the nature of our terrain and the extent and number of

our snowfields and glaciers in spite of the comparatively low altitude of most of the peaks. The difference in latitude (with its consequent effect on the altitude of timber line) between Jasper Park and the mountains around Camp Hale, Colorado, is of course the determining factor. No doubt also our mountains receive a great deal more precipitation.

The R. C. A. F. placed two Norsemen aircraft at our disposal, with three experienced "bush" pilots, two of whom, F. O. Braun and F. O. Pat Ivey, were Americans. During March and April these machines were kept busy doing photographic work and reconnaissance. Supplies were dropped with and without parachutes to troops on extended patrols and ski landings were made on Maligne, Amethyst and Brazeau Lakes. Some magnificent movies and stills of the high peaks of the continental divide were made from the planes by cameramen of the Canadian National Film Board. In all a total of 85 sorties were flown and 13,000 pounds of freight carried.

Considering the nature of the terrain and the complete inexperience of the trainees our casualties were very light and only one fatality has to be recorded. A snow-slide which fell off Nigel Peak on January 20th caused the death of Corporal Collie of the Lovats. If the troops had been supplied with the thin red avalanche cord, which Swiss troops trail behind them when crossing dangerous slopes, its use might have enabled the other men in the party to find the victim quickly and dig him out in time to save his life. This simple, light and inexpensive safeguard should be carried by all ski-mountaineers who have occasion to cross avalanche slopes. It has saved a great many lives in Switzerland. Several other parties were involved in snow-slides during the course of the winter, but except for the loss of equipment, skis, rifles, etc., and one broken leg, no serious casualties resulted.

A number of crevasse mishaps occurred, but careful use of the rope prevented serious consequences. The most dangerous time of all is in the late fall, when there is enough snow to mask many crevasses but not enough to bridge them securely. Mid-winter and spring conditions are far safer. It must, however, be borne in mind that as the crevasse hazard decreases so the snow-slide danger increases. The price of safety is constant vigilance.

The training of the U. S. Army mountain troops at Camp Hale and elsewhere, and the Lovat Scout training in the Jasper area,

has laid a solid foundation of mountain warfare technique and this was put to good use against the enemy in the campaign in the Apennines in Italy, where the 10th Mountain Infantry Division won signal distinction. It is a matter of personal satisfaction to many members of both the A. C. C. and the A. A. C. that they had a hand in the training of troops in the art of mountaineering, and it is to be hoped that many of those who fought with distinction in the mountains of Italy will come back and test their mettle and their skill against worthy mountain opponents in this fair land. We still have hundreds of unclimbed peaks in the Canadian Rockies and great areas of unexplored mountain country.

There remaineth yet very much land to be possessed.

Italy: The Riva Ridge

WILSON WARE

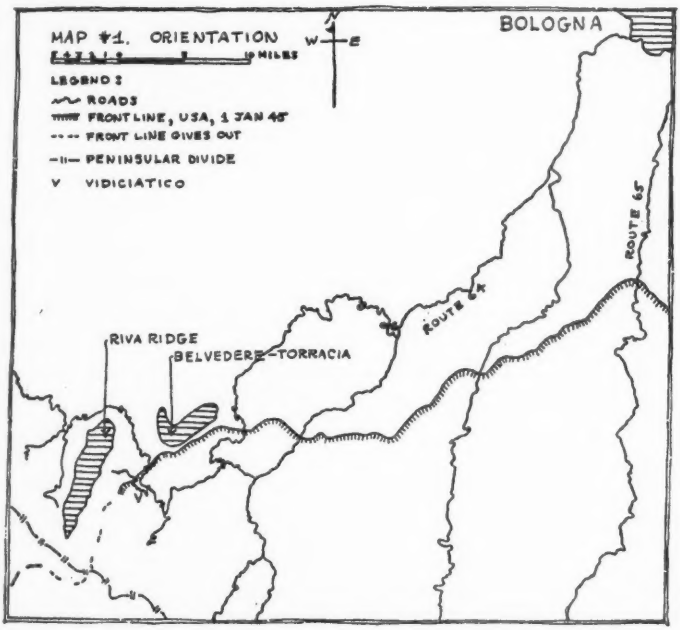
THIS story really begins in the winter of 1942, back in the "good old days" when the 10th Mountain Division was a single battalion of enthusiastic volunteers. These were the days of Mt. Rainier, the experimental, glee club days. Back then, and always ever since till its deactivation in the fall of 1945—division strong, battle tested and proud—there were two bright topics of unit harangue: equipment and training, or what might be called the "what-kind-of-outfit-are-we" line. Everyone knew the equipment intimately; he ate it, wore it, lived in it, and mainly groused about it, even as he prized it, for any of a thousand reasons. Training talk, though hazier, was based largely on conflicting and paradoxical appearance, experiment, indirection, and rumored indecision among the higher-ups as to our worth and possible use. Then again there were opposing factions, weak and strong, who lobbied for snowshoes, skis, flat-land tactics, air supply by parachute, and even some who wanted no mountain troops at all. Twenty years from now old members of the outfit will still remember, with warmth or bitterness, that talk; and will still retalk it when they meet.

Well, what of it all? The talk and the training. Did it work? Was it proved?

Yes. It was proved brilliantly and decisively. It was proved by the attack on the Belvedere-Torraccia land mass, by two subsequent limited objective attacks which covered over a score of mountains and advanced the front roughly fifteen miles, so rapidly and shatteringly that prisoners repeatedly said, "Why don't you go on? Where? To the Alps! We have no front left. Nothing. . . ." The training was proved by German opinion, which rushed the finest troops available to the area, which dubbed the division "Elite Mountain Troops." . . . "Watch out for them. They attack powerfully from unconventional directions and in unconventional ways." It was proved by commendations and citations from theater and army commanders. It was proved by the cracking of the Apennine Winter Line, by the first crossing of the River Po, by. . . .

But that is another story. This one concerns a single action, a subsidiary but vitally important phase of the taking of Belvedere:

the attack and holding of the Riva Ridge. It is offered with a double apology: as an account of mountain troops in a mountain operation; and as evidence of their use and of their worth. It is the opinion of qualified men that this operation, if no other, was accomplished only because of mountain knowledge and mountain training. It remains to be seen if in this account the fact can be shown.



The Belvedere-Torraccia section of the Apennines is a straggling mass four miles long, some 4500 ft. high, and roughly thirty air miles southwest of Bologna. Because of the concentrated lines of communication to and through Bologna, this city was considered the key to the Po Valley. And so it was. No one realized this more than the Germans themselves, who ringed it with defenses, thirty miles and six layers deep. The British, in January, 1945, attacking from the east and the south, advanced with cost and pathetic slowness. The Americans, attacking numbers of times along the main routes from Florence to the north, were stopped in their tracks

after transforming the countryside into an eerie waste with their efforts. Mt. Belvedere was the most important western salient of the entire German line of defense. Southwest of it the main chain of the Apennines became so rugged that offensive warfare was impossible for either side. Only a handful of poor and tortuous roads, which did not lead to Bologna, served the area, some thirty miles across, between Mt. Belvedere and the main highway along the Tyrrhenian coast. Whoever held Belvedere held not only a cornerstone of the German defense, but also a height of land between central Italy and the Po Valley.

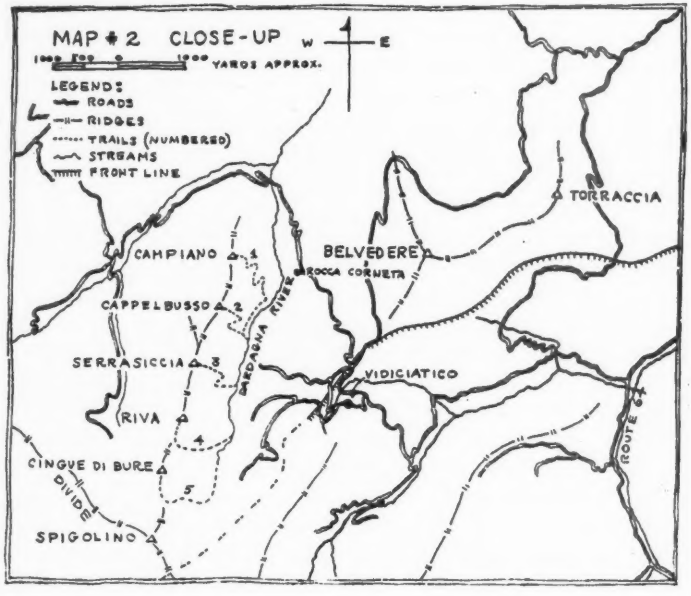
Two different American outfits had tried to take the mountain frontally without success. More than that, they had left many men and burning tanks; they had been thrown off, able to rally only on the lower slopes where they had started. And yet the mountain had to be taken. For like everything in war it was a choice of evils, and this one seemed the lesser.

The mountain, technically, did not present too great difficulty. It was not steep. Farmed nearly to the top on all sides, it would in peacetime, on a summer's afternoon, have offered a pleasant hike up across fields, through quaint hamlets, along winding lanes; but not now. From the summit you could see all roads leading toward it from every direction for fifteen miles. An army must have continuous supply and supply requires movement over roads, but in this case every road was under enemy observation. If the summit were taken, as it had been once, there was to the west a ridge, the Riva Ridge, which not only had observation over all the supply routes which Mt. Belvedere commanded, but over across at Mt. Belvedere itself.

Riva Ridge was so precipitous that no attack in strength could be launched from it or supplied across it. Another disadvantage from the American point of view was that it faced in the wrong direction, but it did have observation, commanding observation. From it all avenues of approach to itself and to Mt. Belvedere could be seen. From it troops in the vicinity could be observed if they massed or advanced. From it artillery could be directed to almost any spot desired, through observation of the enemy's actions. The Belvedere-Torraccia and the Riva ridges were the keys to invaluable knowledge. Mutually supporting, they were almost invulnerable.

Troops who had twice before suffered defeat at Mt. Belvedere no doubt had cursed the Riva Ridge as only weary, frightened, and

bitter soldiers can curse. Perhaps their training, attitude of mind, and lack of winter equipment had made success impossible. Anyway they had not succeeded.



On January 8th, 1945, the 1st Battalion, 86th Mountain Infantry, moved into the sector centering on the village of Vidiciatico. Their positions on that freezing night were a series of strong points ranged along a vast but easy ridge, which runs southwest from Belvedere itself. Theirs was the extreme left flank of the "Bologna Front," nine miles across from Belvedere to the peninsular divide. When light came they could see their "area of responsibility": the easy western slopes of Mt. Belvedere, from the summit to the village of Rocca Corneta; and the Riva Ridge. The one stretched perhaps 2000 yards from the upper right to below and in front. It was on an angle, 400 to 1800 yards away, and a strongly defended line. The latter, the Riva Ridge, stretched from front to left and far up a valley-gorge, frozen and towering. It was a wall, lightly held perhaps by patrols, and with observation points. No one knew very well, for it was of course impossible.

To all men a ridge of this sort is cause for concern; to mountain men particularly, it is of interest too. Five and a half miles long, the major element of this part of the front, the ridge stretches generally N.E. from Monte Spigolino (6400 ft.), on the peninsular divide, to Monte Campiano (4200 ft.), a series of six connected summits repeated in order: Spigolino, Cinque di Bure, Riva-Mancinello, Serrasiccia, Cappelbusso, and Campiano. Each summit commands the next, for each is only actually part of a sharp arête. The average altitude difference, ridge to valley, is 2000 ft., not huge as mountains go, but precipitous and very huge in a soldier's mind.

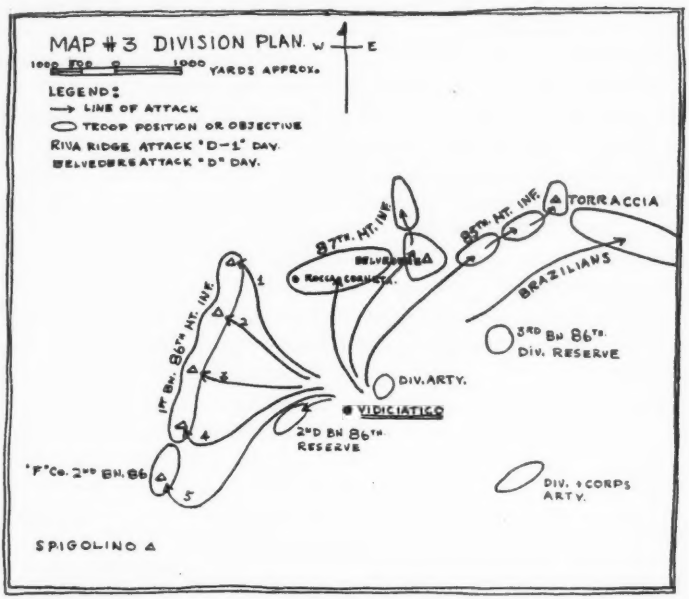
The land before our positions sloped gently for perhaps a thousand yards to the Dardagna, a rushing mountain stream, with rolling fields dotted with tiny hamlets on the other side below the ridge. On the friendly side of the stream the ground had a very steep average gradient, perhaps 45°, with a series of gullies and buttresses banded with outcrops of rotten shale, some twenty ft. high. On the enemy side the altitude difference was appreciably less and the gradient easy, say from 10 to 20 degrees. A large plateau, almost 500 yards wide, lay along the central part between Mancinello and Serrasiccia—an ideal battleground. On the friendly side there was no habitation except three deserted cabins and a few trees, though thick brush in places grew among the talus between the cliff bands. On the enemy side, the farmland was dotted with trees, small villages, and a network of mule paths. Only the extreme upper end near Spigolino, and the lower end around the final buttress, Campiano, were steep, deserted and rough. It seemed a heaven-sent defensive position, but hell to attack.

Even prevailing storm winds favored the enemy. The weather that first morning and for a month thereafter was cold and frozen and white. A foot and a half of snow in the valley rapidly became four. The winds came from the northwest, from behind the ridge, so that our area became a trap with settled powder in the ravines twenty feet deep and iced on the bare cliffs.

It was a "set-up" for the Kraut. He could look down the throat of every defense and foxhole we had; he could watch our every movement; he could foretell our intentions. We saw him occasionally on patrols along the ridge, digging out an implacement, watching us with telescopes. Sometimes he would stand up and take wild burp-gun bursts at us. He could afford to be arrogant for he had to his front what he thought was an unclimbable wall.

Perhaps we can't blame him, for no previous unit had thought

of climbing it, much less tried it. It was considered inconceivable that attack could or would come from the ridge itself, and inconceivable that attack could be launched in that direction. No. Their eyes were turned to Belvedere; and so initially were ours. Three



patrols were required a day—reconnaissance, combat, and prisoner capturing—aside from the "normal" security patrols across the mountains to the rear and to the units right and left. There was much to learn, and there were no rumors or orders for attack.

To go back a bit, one of the dark moments in 10th Division history, particularly to the many men genuinely interested in the mountains and mountain troops—had been the sudden and unexplained move from Colorado to Texas the previous spring. At that time all mountain equipment of every sort had been taken away. Now, equipped with standard infantry items, including combat boots, four blankets per man, and overcoats, plus a few shoepacs, arctics, and "jungle" (or cargo) packs (an invention apparently of the same fiend who designed the old infantry haversack), the 1st Battalion, 86th Mt. Infantry, made its fourteen-mile night relief to Vidiciatico. With the same equipment it was the next day

expected to operate five patrols, varying in size from five to eighteen men, in distance 500 to 6000 yards, and in snow conditions from thigh-deep powder to wind-blown crust and ice-covered rock. The much maligned and much discussed mountain equipment of the Camp Hale days was never so much regretted as at that moment; and for all anyone could discover there was little or none of it in all of Italy.

During the next weeks the situation was somewhat remedied by superhuman efforts of the regimental and divisional supply officers. Everyone was issued either parkas or camouflaged alpaca coats. Everyone got shoepacs, alpaca caps and hoods. Twenty-four and finally forty pairs of snowshoes were issued per battalion; fifteen and finally thirty pairs of skis, thirty pairs of mountain boots, 100 rucksacks, but no ice axes, no rope, no pitons, and no crampons. This for between eight and nine hundred men. Finally, when spring was close, some sleeping bags and mountain stoves appeared.

Patrols, in these early days, were accomplished with difficulty. Mattress covers were cut to make white tunics. "Creepers" for shoepacs were fashioned out of knotted ropes. A few skis were borrowed from natives and used with GI shoes. The defunct local branch of the Italian Alpine Club was contacted to try to secure a few ice-axes and crampons. None were available. Typical of patrol problems was the example of a group which left one night under a fine officer, struggled nine hours in powder in places up to their chests, reported back finally exhausted, not having reached their objective, to find at dawn that their tracks had not gone farther than 250 yards from their positions!

Our men, with training if not equipment, did remarkably well. What skis and snowshoes we had were interchanged from platoon to platoon and company to company (irrespective of size or fit). Warm camouflaged clothing was exchanged as needed, and given this barest of equipment patrols started to operate. Miles of country were covered; small groups crossed mountain ranges to contact our next battalion eleven miles away, took prisoners right out of the German front line, finally climbed the Riva Ridge itself and killed the men encountered on top, and stirred up such a row that agents reported the arrival of two mountain trained battalions in enemy reserve.

At first, as I have said, patrolling was not concerned with "the ridge," but that came later, inevitably. Our men were accustomed to be on the top of things, as well as our thoughtful and aggressive

CO, Lt. Col. Henry Hampton. One night a patrol attempted to reach the lowest summit of the ridge, Campiano, along what the map indicated as a trail. It was a path about a foot wide, often obliterated, sometimes cut into the rock, which traversed a great shoulder of cliff and zig-zagged up through ravines with frozen waterfalls towards the summit. The men went about two-thirds of the way to the summit that night without enemy contact, using skis to the base and "creepers" from there until stopped by an ice slope in a ravine.

The very next day, before Division Headquarters could have received the report, a patrol was ordered to the top. We were glad then of the experience, for this patrol went by day, circumnavigated the ice slope, surprised three Germans on the summit so much that in their gaping astonishment they could hardly raise their rifles to fire, killed them, and returned. Immediately three "confirmed" enemy positions and patrol routes became eighteen, one OP changed to four, and mortar rounds began dropping from behind the ridge. There was wild and to us somewhat humorous digging and snow-shoveling along the crest. We had stirred them up. The ridge was not "impossible."

It stirred us up as well. From that moment there was almost an obsession among the command group of the battalion to take the ridge, to show that mountain troops would work. Nor was it too long before the idea passed all through the "recommendation" stages of regiment, division, and corps to return as an order to prepare a plan of attack for an unspecified date, in conjunction with an attack on the Belvedere-Torraccia Ridge, for such was the audacious plan of our division commander, Major General Hayes.

It is the basic rule of mountain tactics to get on a ridge or on a summit as quickly as possible and attack down, so as to attain "ground advantage," if for no other reason than that a man is at a tremendous disadvantage fighting uphill. The natural inclination then was to try to find a covered hidden route around to the wind-swept reaches of Spigolino, where we knew from patrols that the enemy had only four or five men in a mountain climbers' hut. Here they would have ground advantage and could attack down along the ridge. Patrols were sent to determine the possibility of this, and their information was recorded and studied in detail and with the utmost care. The battalion would have to move with all supplies, attack, hold, and remain supplied. Supply. That was the important word. After careful analysis the attack appeared not

feasible, for there was no covered route, nor any for mules or weasels[1] (we now had two of these). Supply would be all man-carry; an incredible task to perform over a distance of eleven miles and up to a rise of 4000 ft., in full view of the enemy, and with snow hard enough to make stamping with steel-edged skis obligatory. An extra man for every man in the battalion would hardly have sufficed, even with skis, and besides there was that plateau half way along. If we were discovered in movement, the enemy would have ample time to deploy at the plateau near Mancinello, even bring up reserves before we arrived, and put up a mighty uncomfortable fight. Not to mention the certainty of being able to hack us up with artillery before we arrived.

What then of a single route up the face somewhere near the middle, and then a fanning up and down the ridge? Patrols were dispatched to find this route. The decision, however, was that the climbing of the face was so exposed that a battalion massed at the base and climbing a single trail could be cut to pieces by just a few men and an artillery observer. Also it would take hours, even days, to get a battalion up just one trail. Discovered, the battalion could almost be picked off man by man as they reached the crest. There was absolutely no possibility of deployment on the face itself.

No. The only possibility was multiple routes on the face. There must be surprise, and each summit must be reached at approximately the same time, so as to keep the surprise and to insure that one German strongpoint could not be reinforced by another or reserves brought up generally. It was an audacious plan to put it mildly, one which must work or utterly fail. Not least of the problems was to find a trail, possible for all men, directly to each summit.

The planning of this operation began about the middle of January. Two or three patrols a day went searching for routes, besides still more aggressive patrolling in the Belvedere-Rocca Corneta sector to make the Kraut think we were interested in that area. We already had "Route 1" to Campiano; this must be made to work. The map indicated a "mule trail" up to Cappelbusso; this we hoped could become a supply trail for it was covered. By the end of January every summit was reached somehow, after repeated tries. All this reconnaissance was done at night on the steep face, with little equipment, but with continuous hazard. Men were

[1] The T-29 or "weasel" is a light tracked vehicle with wide tracks used for travel over snow.

buried in deep falls of powder snow in ravines, where they had to be found and dug out. Men fell in the stream at the base (there was one bridge only) and came near to freezing to death. Two men fell four hundred feet down an ice slope because they could not cut good enough steps with bayonets! An account of these patrols alone is a story of heroism and an irrefutable proof of what mountain training can do for the inconspicuous and unsung "dog-face."

Three to one superiority is considered necessary for successful attack on the flat-land; ten to one in the mountains. All sources of intelligence indicated about seventy men on the ridge with an under strength (400) but well trained battalion of mountain troops in reserve. At ten to one a U. S. Army battalion reinforced with a rifle company (850 plus 180) was not too much, for the job was to take, and also to hold. Early in the game, therefore, each company was assigned its summit and route area, and patrolling was done by the men who would finally climb each trail. It is desirable to emphasize here that by this system not one small group of specialists did the work, but the average "GI," mountain trained.

About 1 February the battalion was relieved and moved to a rest area just north of Lucca, where the plan was perfected and the final training and orientation accomplished. The training consisted of rock climbing on terrain as closely resembling "the ridge" as possible. It included study of large annotated maps and air photos of the ridge, study of a sand table model of it, and study and consequent knowledge by every member of the command of the entire plan and his place in it. This aspect of the plan of each company is of note: each one was to be preceded on its trail by an assault platoon picked at random; each assault platoon was to be preceded one half hour by three expert mountain men to pick trail and fix ropes where necessary. The ascent was to be done at night, without any noise, and even piton hammers (we were to receive this equipment at last) were to be wrapped in cloth.

A list of strengths and armament is also of interest, to give an idea of the force concerned. The attack was to entail the 1st Battalion, 86th Mt. Infantry, plus "F" Company of the 2nd Battalion, plus the remainder of the 2nd Battalion in reserve. Attached were one platoon of tanks (4); and one platoon of tank destroyers for direct fire on the ridge if necessary; eight "50" cal. machine guns; one Company (9) of "4.2" inch mortars; nine extra "81" mil. mortars; all of our division artillery (thirty-six "75" mil. howitzers

and twelve "105" mil. howitzers); plus any Corps Artillery we cared to call upon ("105s" and "155s"). This was a formidable array to be at the call of a battalion.

Finally, a brief outline of the division plan is also of note to give the relation of this one phase to the whole. The Riva Ridge was to be taken on the night of 18-19 February—taken and held in order to close that avenue of observation and to divert strength possibly from the Belvedere line. Then, one night later, the remainder of the division (13,000 men) was to pour through the Vidiciatico sector on an arc, flank Mt. Belvedere from the west, and capture it and the whole ridge to Torraccia within one day. The Brazilian Expeditionary Force (one division), pinched out by this action, was on the same day to shift to the right and fill the gap left by this advance. It was an extremely audacious plan, for it must be remembered that a whole division had to mass, in attempted secrecy, by night, under the very noses and in full view of the enemy. To anyone familiar with what this means in artillery emplacement and stock-piling of supply the undertaking is almost unbelievable.

Supply. Supply and equipment were still the ogres constantly at hand. Supply was to be handled by an Italian Mule Pack Company (about thirty small and agitated mules) and by a porter platoon (forty men) from our regiment. Priorities were set: ammunition first and always; evacuation of wounded second (this by the Battalion Aid Section and an attached Collecting Company); and as a bad third, food and water. As soon as the ridge was secured, an aerial tramway was to be built by the engineers to a buttress near the supply trail, "No. 2." This would speed things enormously, when it was done. An aggravation was our obligation to get the "50" caliber machine guns and a pack howitzer up the ridge for direct fire in aid of the division next day. A "75" pack howitzer alone weighs nearly 1300 pounds!

Equipment. Would it still be winter? Would the thaw come? We were now assured by Army that we could have all the skis and snowshoes we wanted. (Where had they been?) We were prepared, at least, to move the whole battalion on skis.

On 12 February a small group—mountain climbers from each company, the author, and the men of the Intelligence Section—returned to the ridge to check last details. Fate had been kind. Spring had come with a bound. South slopes were bare, snow was in most cases hard packed, and days were almost balmy, while

freezing at night caused convenient screening mists. We would not need skis; we would not need so much clothing, and the men could carry more ammunition. The only hitch was mud, Italian mud, and what might be called overcrowding. Already the division was beginning to mass. Most movement was at night, but each morning saw more new guns exposed in new emplacements, new roads plowed, new trucks (hundreds of trucks it seemed) in every shadow along every lane. And everywhere were growing piles of food and ammunition crates and gasoline cans along the roads. Unavoidable. But what of the Kraut? And what of our surprise!

On the night of 17 February, blessed with a friendly blanket of mist, the battalion moved into its positions, little hamlets out in "no man's land" near the base of each trail. All day of the 18th it waited in the houses, quiet, fireless. On the night of 18 February at 2230 the men started to climb the ridge. All was still. No artillery was to be used unless a fight started, and not until light at that. "Normal patrols were active," and the hours were interminable. At 0545 on the morning of the 19th, just as dawn approached, the last unit reported by radio, "In position."

The enemy? Prisoners later informed us that fate had again been kind to us: surprise was complete for we had caught the Krauts in the middle of a careless relief, and we had also caught them in a careless blunder: there was no lateral communication along the ridge. As each outpost attacked thought it was being attacked by an isolated patrol, there was no realization of a general assault. The enemy did not know what had happened until the attack was over, so complete had been the myth of the ridge's invulnerability.

Hadn't they seen the massing? "Yes," they said, "but Americans are crazy. They are always moving around in the open. We didn't think it meant anything." At first dawn found the ridge a melee of confusion. Germans were surprised asleep in their bunkers and surrendered in thunderstruck groups; those who resisted were dispatched in isolated bursts of fire, while others ran wildly. The reinforced platoon which attacked Campiano continued on to two small houses on the far side, where they killed several men, took food, small arms, artillery equipment, ammunition, two mortars, and valuable documents. The attack was complete without a single American casualty. All parties reached their assigned positions and the "impossible" had been accomplished.

To attack and to hold are very different, as the enemy knew well. It did not take him long to retaliate, for though he had been caught in a grave error of underestimation of his opponent, he knew the value of that ridge; and was to know it even better when the next night, following a shattering barrage, the rest of the division moved in successfully on Mt. Belvedere. His advantage was now lost and his pride badly battered, as shown by the fact that in the next two days various parts of the battalion received six counterattacks in force up to company strength, numerous smaller assaults, and continuing artillery. The defense of Campiano alone is a chapter. This, though lowest of the summits, was under continuous counterattack for five days, many times completely surrounded, once in such a critical position that Krauts were crawling in among the positions themselves and the men holding it had to call for artillery and "50" caliber machine-gun fire on their own position. Lt. Col. Hampton personally led a reinforcing platoon down a knife-edge ridge to its partial relief. Here men comparatively new to combat vomited at the sight of the dead and broken Germans before the position, rotting in the sun. . . .

A few more details need to be recorded. The pack howitzer and the "50" calibers got to the ridge and fired on time, though one mule died of exhaustion on the way. The tram was up in about a day. Men, mules, and tram carried ten and a half tons of ammunition to the ridge in the five days we were there. Even food and water came after three days. Evacuation of wounded was heartrending, for eight to ten men were required per stretcher, as well as ropes, sweat, and infinite care. Evacuation from Campiano, just off the ridge and not to a hospital, took thirteen hours. From Cappelbusso evacuation down the "Supply Trail" took eight hours. Living was basic: shallow frozen holes were used with one blanket or half a sleeping bag (and they went to the wounded); at first no food was available and then frozen "K" rations at last; water was scarce or lacking; and attacks were constant or near constant day and night. But the men of the 10th were used to frozen food, were at home in the mountains, and were unconventional. In a strange sort of way they liked being up there.

On the day of February 23rd, 1945, the 1st Battalion, 86th Mountain Infantry, straggled in little groups off the Riva Ridge. Their rear was still in view of the enemy, so the relief was made not to look like a movement. The ridge was fairly quiet, for the enemy had accepted defeat. And the battalion was being relieved.

Making Climate an Ally

WELDON F. HEALD

A NEIGHBOR of ours, a white-haired, retired colonel, asked my wife early in the war, "What is your husband doing in the army?"

"He's in the Climatology Section of the Quartermaster Corps," she said.

"Climatology!" exclaimed the colonel. "What's the Quartermaster got to do with climate?"

"Why," my wife explained, "their job is to find the exact climatic conditions throughout the year on all world fronts so that the physiological stresses and strains on our troops may be minimized by proper equipment and amounts of clothing. They call it environmental protection." Maybe she didn't say it just like that, but it was what she meant.

The old colonel shook his head. "I don't understand this newfangled way of fighting wars," he said. "When I was in Cuba and the Philippines in '98 we'd find out where the enemy was, go there and engage him. That's how we won."

The colonel wasn't any more old-fashioned than most of us back in 1942. We thought of war in terms of guns, bombs, planes, men, blood and sweat. Few realized that in past wars climate and disease have been our deadliest enemies—or if they did, it was one of those things which couldn't be helped.

But World War II was global. Our troops fought in steamy tropics, burning deserts and arctic snows. To be efficient fighting machines they had to become adjusted to their environment and protected from unfamiliar climatic conditions. So, soon after Pearl Harbor, the Quartermaster General called in explorers, mountain climbers, desert rats, outdoorsmen from all over the country, gave them desks, and told them to go to work. This group became a part of the Research and Development Branch of the Quartermaster General's office. They designed all QM clothing and personal equipment for our troops in World War II.

However, no matter how efficient clothing, sleeping bags or tents may be under certain climatic conditions, they cannot be issued intelligently to troops unless we know exactly where and

when these conditions occur. For instance, the Arctic sleeping bag is a beautiful piece of environmental protection in central Alaska in January, but would produce Indian sweathouse conditions on an average winter night in Tennessee. Just where should the line be drawn south of which the Arctic bag becomes inefficient due to increased temperatures? How does that line vary from season to season? Answering these questions, and hundreds like them, involving temperatures, winds, rainfall, snow conditions, humidity, mud and dust, was the principal job of the Climatology Section. In other words, we tried to evaluate clothing and equipment needs throughout the year in terms of the actual climates found in all parts of the world.

First we had to find out what a man needs to function efficiently under various conditions of environment. Basically, this meant a thorough study of human bodily reactions to heat, cold and other climatic factors. Only by testing men under actual conditions can you discover how much protective insulation is necessary to insure restful sleep at −50° or how many kilogram calories per hour of energy a human being can safely expend in combat under a desert sun.

A scale of clothing insulation values was adopted using "clo" or "layer" units, with each unit equal to about a quarter inch thickness of standard material. Then all clothing and equipment designed by the Research and Development Branch was tested in the field and in the fifteen laboratories associated with QM during the war. Hundreds of these tests simulating actual conditions of heat, cold, wet and wind were performed with living subjects at the Lawrence Climatic Research, Harvard Fatigue and other laboratories, while field tests were held under varying climatic conditions from Florida to Alaska. So little by little a knowledge was acquired of the "layer" value of each item as well as how many "layers" were required to keep men comfortable, or at least efficient, under all types of weather.

The second job of the Climatology Section was to assemble climatic data from all available sources. From world-wide figures for temperature, rainfall, winds, snow and humidity we were able to estimate pretty closely what conditions would be encountered by our troops in all parts of the world at any season of the year. Knowing the environmental factors and under what climatic conditions each item performed most efficiently, a system of geographical

distribution zones based upon climate could be set up for properly clothing and equipping the entire army.

This seemingly logical system, with its mathematical overtones, appears in retrospect to be a dispassionate, straightforward process. However, I have no desire to be misleading. In true Washington fashion our progress was halting and hesitant; it was punctuated by ignorance, prejudice, complications, endless discussions, trial, error and downright mistakes. Clothing and equipping the United States Army based upon actual climatic needs was new, an untried experiment, and it won friends with exasperating slowness.

Early in the work we realized that climatic maps indicated world conditions more graphically than any other method. However, the existing maps, such as Koppen's and Thornthwaite's, were unsuitable for our purposes. They divided the world into permanent year-round regional zones while we had to show how climate varied throughout the twelve months.

The climate maps evolved by the Climatology Section were, therefore, based on a new principle. They were plotted and drawn for each separate month so that there are twelve maps for every area chosen. By this method it is possible, without training in climatology or elaborate interpretation, to tell immediately the climatic conditions of any locality within the region covered by the maps. The thirteen colored zones, based on differences in average temperature, precipitation, snowfall, humidity, etc., are not stationary, but slide north and south across the face of the earth month by month. Wherever located, every zone retains its same climatic characteristics each month of the year whether found on a January or July map. For example, the *Mild Humid Zone,* which covers Florida in January, travels northward during the spring and is found over northern New England and eastern Canada in July. That it is a pleasant resort climate is attested by the fact that people seek it in Florida in winter and the north during the summer months. I might add for the benefit of the Los Angeles Chamber of Commerce that a piece of this zone spends the winter in southern California also.

The maps provide for those lacking in technical training a simple means of comparing average temperatures and precipitation between familiar and unfamiliar regions. The colored zone system allows comparison between any locality on another continent with familiar areas in the United States having the same color. The *Warm Humid Zone* in which Tokyo is located in July also covers

Washington during that month, so presumably the climates would be similar enough to require the same clothing and equipment. This is not strictly true, however, as identical averages may result from widely different variables. Therefore a table of temperature and rainfall variations showing the seasonal extremes which may be encountered in each area accompanies each map.

With these Climate Zone maps, the key showing the average climatic conditions of each zone, and the table of variations, the QM was able to draw up a fairly accurate estimate of clothing requirements throughout the world. In fact, the Climatology Section drew numerous clothing zone maps which showed directly the number of insulating layers needed in each area during the year. With these maps, laboratory tests and the field experience of the outdoor experts of Research and Development Branch—nicknamed "The Iron Men"—a new Quartermaster Table of Equipment was evolved. For the first time in the army's history an attempt had been made to base distribution zones upon actual climatic conditions!

The Section's hundreds of Climate Zone maps and graphs proved useful during the war to all branches of the army, navy and marines. Climate is an important factor in all military planning. And they should prove of value to peacetime travellers and explorers as well as to clothing manufacturers and those planning large scale development projects.

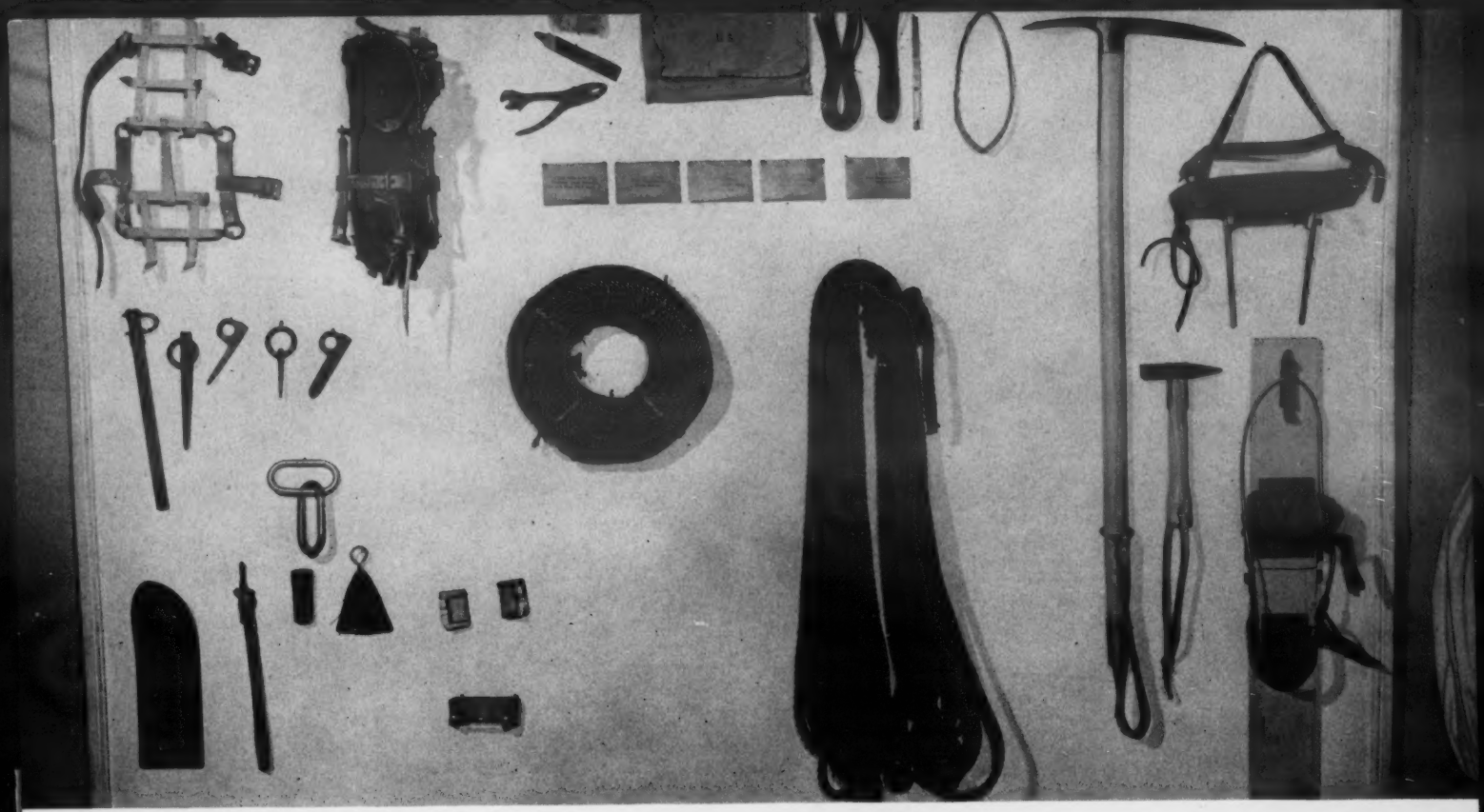
Of particular interest to mountain climbers, however, is a mapping project recently set up in the Climatology Section. It is planned to map the mountain ranges of the world on the Climate Zone system. Although designed for army use, these maps will furnish accurate, non-technical information on mountain climate to climbers, explorers, skiers and campers. A detailed text will accompany the maps, enabling one to correlate correct clothing and equipment throughout the year with the zones shown on the maps. Other environmental factors, such as vegetation and insects, will be included as well as seasonal snow and storm conditions. Such maps, if accurate data can be secured, should go a long way towards taking the guesswork out of mountain climbing expeditions.

Both at peace and in war climate can prove an upsetting element in planning—from the shower which spoils the picnic to the storm that wrecked the Spanish Armada. We cannot change the climate—we wouldn't if we could—but at long last negotiations have been started for a unilateral treaty of alliance with the elements.

U. S. ARMY MOUNTAIN AND COLD WEATHER EQUIPMENT

Top row, left to right: shoepacs, ski-mountain goggles, wool ski socks. *Center:* mountain sleeping bag. *Lower row:* rucksack, plywood packboard, one burner stove, mittens and inserts, ski-mountain boots, bearpaw snowshoes. Exhibit is in nylon two man mountain tent with one side removed.

Photo, Courtesy War Dept.



U. S. ARMY MOUNTAIN EQUIPMENT

Top row, left to right: crampons, ski repair kit with contents, iceaxe, hinged binding for bearpaw snowshoe. *Middle row, left to right:* ice piton, 4 types of rock pitons, ¼ inch rapelling rope 200 ft. long, 7/16 inch, nylon climbing rope, piton hammer, ski binding. *Lower row, left to right:* ski repair tip, ski safety strap, steel and aluminum snaplinks, waterproof matchbox, mountain brush, ski adaptors.

Photo, Courtesy War Dept.

strap, steel and aluminum snaplinks, waterproof matchbox, mountain brush, ski adaptors.

Photo, Courtesy War Dept.

Photo, Courtesy War Dept.

Mountain Equipment for the U. S. Army

WILLIAM P. HOUSE

FEW mountain climbers there are who have not spent untold hours arguing over the merits of this or that ice axe, or whether Tricouni or Swiss edge nails are better, or any one of the innumerable controversial subjects involved in mountaineering equipment. Mountain climbers are at least on a par in this respect with fishermen, yachtsmen, hunters, golfers and others who are attracted by specialized sports in which equipment figures prominently. When you add to personal prejudices and idiosyncrasies the added problem of military requirements, you create a field for discussion even more than usually conducive to difference of opinion. Members of the 10th Mt. Division and other army personnel who had occasion to use specialized Quartermaster clothing and equipment are well aware of this, as are those of us who worked on the design end.

Because research and development in Quartermaster equipment brought to light and use many new materials and designs in large measure free from personal prejudices, a discussion of some of the major developments in army mountain equipment should be of interest to most mountaineers. Of at least equal interest are the various factors peculiar to military requirements which necessitated divergence from many accepted civilian concepts of "the right piece of equipment."

As is well known, the U. S. Army up to the beginning of World War II had no substantial experience in mountain or cold weather problems. Unfortunately lessons on cold weather problems learned in the first World War were forgotten and were not available when the need for them arose. As far as mountain problems were concerned, considerable experience had been available from mountain fighting in the Philippines. None was available on temperate or cold weather mountains, however, since the possibility of the need for this type of fighting had not been foreseen. Therefore neither equipment nor tactical understanding existed.

Fortunately during the winter of 1940 and 1941 a start was made on the cold weather equipment problem, notably by Maj. General Simon Buckner, then in command of the Alaska Defense Command. He immediately called on the Quartermaster to in-

itiate action to make available suitable cold weather clothing and equipment to enable his troops to operate effectively outside their barracks. Likewise in the War Department there were a few officers who believed so strongly in the need for troops able to operate in any kind of weather and over any terrain, that they were able to initiate maneuvers for testing tactics, logistics and equipment in Wisconsin in the winter of 1940-41, and on the Wood Yukon Expedition the following summer. On the latter, rations and personal equipment were supplied and an official observer, Captain Albert H. Jackman, was detailed to accompany the expedition to report on the military problems connected with travel in glacier and high mountain country.

As the result of all these reasons, the fall of 1941 found the War Department very much concerned with the problem of equipment and desirous of making use of the best available civilian experience. Following a series of conferences attended by many of the leading mountaineers and skiers of the country, it was decided that experienced personnel were needed to design, correct and test equipment, rather than to rely merely on advice to procurement officers on what was believed to be the most suitable equipment.

Great credit is due Colonel L. O. Grice who as chief of the Standardization Branch of the Office of the Quartermaster General started to build an organization of qualified personnel with experience in the fields of cold weather and mountain problems. With them he planned to design completely new functional equipment for the Army's prospective mountain divisions, for troops in Iceland and Greenland, and for such requirements in Arctic and cold weather warfare as might develop. Robert Bates was called from Phillips Exeter Academy to be the first member of the new unit. Others followed in close succession: myself, Bestor Robinson, Adams Carter, Richard Leonard, Terris Moore, Bradford Washburn, as well as men with true arctic experience such as Sir Hubert Wilkins and James Ford.

In the beginning, this group exhibited the same highly individualized opinions that characterize mountain climbers anywhere. There were those who favored Swiss edge nails over Tricounis because they had used them in certain mountains. There were those who thought the Horoschowski design was the only right one for ice axes, and so on with all the many items of equip-

ment that were needed. It soon became apparent that few actual scientific data were available from past experience, and that if we were to get anywhere we would have to study military requirements, combine that knowledge with our own individual backgrounds, and come out with something that was practical for an army, not just the product of our own likes and dislikes.

As might be expected, the influence that purely military requirements had on the choice of equipment was tremendous, though in all the work was the need of understanding the basic problems of rough country travel, and protection from the elements, knowledge we had gained in earlier years.

One of the first considerations was where the equipment was to be used. Mountain ranges differ greatly all over the world. We found ourselves in the amazing position of having to determine where combat was going to take place. Would American troops be involved in the mountains of Greenland or Iceland, Alaska, the Pyrenees, Norway, the Alps, the Caucasus, even the Himalayas? If so, what were the most likely possibilities? Even the General Staff, who were approached for help, could give no advice except that a mountain division was to be formed for mountain fighting, and that in addition suitable equipment would have to be available for a possible arctic campaign. Where? It was not known where, but equipment would have to be supplied troops at the earliest opportunity. Can anyone conceive of a single mountaineering kit which would be usable in any mountain range of the world?

This brought us face to face with the second, and probably the most important, factor in equipment design, one which more than anything has influenced all types of military equipment whether it be boots or field artillery. That was the overwhelming need for a minimum number of types of equipment. Even well before the war it was recognized that the form that the inevitable world-wide war would take would make supply a complex and difficult problem. Lines of supply were sure to be long, relatively inflexible, and subject to interruption, while over and above everything the actual theatres of combat were not known. The result was that in design as well as in choice of materials every single item had to be capable of serving adequately as wide as possible a field of use. Some extremes, of course, were incapable of being reconciled, such as tropic and arctic clothing and foot gear, but every decision on

equipment had to be made in the light of how well each item would work under many different conditions.

As can well be imagined, the compromises that had to be made were substantial and frequently resulted in bitter but understandable complaints on the part of the using troops, who felt that the equipment they were issued was not right for the conditions they were encountering. Despite this and in view of the known problems of supply and the unfamiliarity of the new army with new types of equipment, we felt justified in making every item do as many jobs as reasonably could be expected without seriously impairing its functional utility.

A third maxim that constantly faced us was that soldiers were traditionally hard on equipment. Whereas they might treat their own civilian clothing with reasonable care, the fact that military clothing was issued by the government removed the necessity for caring for it. This attitude was shared by nearly all troops, even a majority of the especially trained mountain troops, and was often not changed until shortage of supply on a combat front made it essential to make their equipment last. An additional factor too was that the job of the soldier was tough and he frequently was not able to protect his clothing and equipment in the same manner as a civilian. Between the two, though, some real design headaches were produced. We knew that lightness was essential to civilians in any kind of movement in the mountains, and was infinitely more important to the soldier, who was already burdened with many pounds of essential fighting equipment not carried by the civilian mountaineer. Boots, windproof clothing, sleeping bags, tents—all had to be made more rugged than for civilian requirements, and until the priceless lightweight nylon fabrics became available, clothing had to be considerably heavier than what we had previously been accustomed to.

A fourth factor, and one of the most frustrating, was material shortages. Quartermaster requirements were low on the list of priorities, especially in the fields of lightweight fabrics and metals. No less important were shortages of productive capacity or of available machines. In many cases compromises in usefulness and durability had to be made because of higher priorities awarded other Army materiel.

Hardly less important than these reasons was the fact that few manufacturers were familiar with the production in volume of

many of the specialized items of equipment needed by the mountain soldier. Often the numerical requirements were too small to interest those equipped for large scale production of mechanical items, while still being too large to permit the individual craftsmanship that had been adequate for civilian demand. Also, most of the equipment was new to procuring officers and inspectors and satisfactory control of quality was difficult.

Over and above everything was the terrible urgency to have the proper equipment in the hands of troops early enough in 1942 and 1943 to enable them to train properly, and if necessary to fight before their training period was up. Little time could be spared for testing, and many pieces of equipment went directly from a few crude prototypes into specifications, and thence up for bid.

Later as the Research and Development Branch of the Quartermaster General's Office expanded under Brigadier General Georges F. Doriot, many of the inadequacies of the earlier emergency methods were corrected. Equipment was more thoroughly tested and the needs of troops more accurately analyzed. Most of the basic designs of the early few months, however, were with improvements still standard at the time of the end of the war.

It is good to know that this same work is continuing in the post war period, and that by expert and complete analysis of military requirements, plus development of new and better materials and their application to the soldiers' needs, better equipment will be available in future years.

For those who either have used specialized mountain equipment in the services or have bought some as war surplus, a brief sketch of the reasons behind specific designs of a few interesting articles is here given.

Ice Axe

Probably no piece of equipment except possibly skis is more subject to individual convictions than the ice axe. Added to this problem was the fact, noted above, that it was not known where mountain troops would fight. If it were to be in the high mountains or in Greenland or parts of Alaska where glacier travel is an important problem, a typical guide's ice axe, capable of heavy ice work, would be needed. If it were to be in lower mountains where the axe would be used only occasionally, a lighter axe with

greater ease of carrying was the logical solution. We decided in favor of the former and chose an axe modeled on the Horoschowski pattern as combining the advantages of sound balance for heavy ice work, yet reasonable portability. As the mountain troops developed their tactics and training, we came to recognize that this decision had not been correct and that the best over-all interests of the mountain soldier would probably have been better met by a lighter axe, even at the expense of heavy step cutting. By that time, however, the requirements for ice axes had ended and time and effort were directed towards more immediately important ends.

Choice of a design was only the beginning. All of us, amateurs in the field of industrial design and manufacture, soon learned that there is a wide gap between a good idea, even one well outlined in a specification, and an acceptable finished project. We found among other things that high grade properly dried ash was not available for the ice axe shaft and had to turn to the heavier hickory. An unauthorized change from specifications in welding of the tangs to the head placed a weld line directly across a rivet hole, a feature invisible in the finished product. For this we got many breakages and heartfelt curses from the soldiers. Also, since neither the manufacturer nor the inspectors recognized the extreme importance of proper balance and alignment of the pick and cutting blade, sloppy workmanship was permitted, which resulted in the pick being considerably less than at right angles to the shaft. This angle resulted in a tendency of the axe to bounce when step cutting, especially when cutting down hill. Eventually, however, these "bugs" were removed, inspection and compliance were made more rigid, and the later axes were good axes, if on the heavy side. It is interesting to note that even with the restrictions of very tight specifications and inspection, the cost to the government was between three and four dollars apiece. In fact one misinformed but enthusiastic manufacturer offered to make 300,000 for one dollar apiece. Doubtless he could have, but the source of his information that the Army intended to buy that many axes still remains a mystery to us all.

Mountain Boots

The first idea that any of us had about boots for mountain troops was that the "Bramani" boot sole of rubber should be investigated. Several had seen it in use in Italy, and the few re-

ports on its performance were very encouraging. It seemed to combine in a very convenient package all the main requirements of a mountain boot sole. It was adaptable to a wide range of mountain surface conditions, such as wet and dry rock, snow, ice, moraines, and rough terrain in general. It was relatively light and flexible, and caused neither noise nor sparks.

Alas, hardly had we begun to think about these soles before an order prohibiting the use of rubber in any new equipment was issued and we had to turn to the more conventional nailed boot. After a lot of discussion the Tricouni type was decided on as the most practical nail, not only on a performance basis but on a production basis as well. Machines to make the Swiss edge nail type were lacking and hand manufacture was out of the question.

A good start in the design of the boot itself had been gained in a model made for the 1941 Wood Yukon Expedition by Bass. This had a sole shaped to fit in a ski binding, but was not so stiff as the usual "down hill" ski boot. The toe was made unusually high to permit the use of a felt insole and to make room for the toes at low temperatures. Although the design was not envisaged as anything like an arctic boot, it was felt that troops in the mountains would have to endure low temperatures and inactivity and therefore needed the maximum of protection. This model with some changes eventually became the Army Ski-Mountain Boot. In large measure due to the early overemphasis on skiing, objection was made to the Tricouni type nails by members of the early mountain units on the ground that they made skiing difficult. This they did, as snow tended to ball up between the sole and the ski, and the Tricouni nails plus the insole tended to place the foot too far above the ski for good stability. A boot with good gripping power was still needed, however, for the period off skis, time which we felt in practice would occupy the greatest part of the mountain troopers' day. Fortunately by early 1943 it was possible to secure compounds of both natural and synthetic rubber and we were able to go ahead on the "Bramani" design. After much experimentation with both compounds and cleat designs, a sole was adopted which we believed better than the original "Bramani" sole. It consisted of a $\frac{3}{16}$-inch rubber sole with $\frac{3}{16}$-inch moulded cleats, "V"-shaped on the middle of the sole and square "U" shaped on the edges, a boot which gave good grip on almost any surface except smooth ice.

This remained the standard mountain boot for winter or cold weather mountaineering and amply justified our efforts to make it a good cold weather boot. No really good summer mountaineering boot was ever adopted, in part because as the war progressed new and special equipment was discouraged for supply reasons and because the generally issued composition sole service boot was found to have surprisingly adequate qualities for everything short of snow and ice climbing.

Mountain Rope

By far the greatest single contribution to mountaineering made in wartime mountain equipment was the nylon rope. Because of the need for quick supply of safe ropes for training purposes we turned at once to the standard high grade Manila ropes used by most civilian mountaineers. However, acute shortage of all grades of Manila hemp, especially the high grades, necessitated an early attempt to find a good substitute. Sisal was a possible choice, although the increase in diameter necessary to provide adequate strength and its low resistance to abrasion made it only a stop-gap solution.

The almost incredible performance of some of the synthetic fibers suggested an investigation there. Under the able direction of Richard Leonard work was undertaken in cooperation with the Plymouth Cordage Company, and tests were made of many different types, consistencies and lays of nylon rope. With no exceptions the final choice of medium lay bright nylon was found to be superior to the highest grades of Manila. Chief and foremost was its great resistance to shock. It was found to absorb over three times the shock loading as the same weight of Manila. As an example, the best grades of Manila could be stretched only to approximately 13% of their length before breakage, whereas the nylon rope would stretch over 39%. In addition to this most important safeguard for the mountaineer, resistance to abrasion was found far greater than in Manila, although the first few hours' use resulted in a frayed appearance which some early testers thought was premature wear. Holding capacity of knots in relation to strength of rope was found better than Manila and moisture absorption was far less.

All in all the advantages were so great that it was expected that they might be put to further use by making the rope thinner

and therefore lighter, while still having a much stronger rope than the conventional 7/16-inch Manila. The Army Mountain and Winter Warfare (Testing) Board decided against this reduction, however, because of possible difficulty in handling. Therefore 7/16-inch diameter nylon with a specification strength of 3400 lbs. and a weight of 6½ lbs. (120 feet) was adopted.

Use of this rope in army rock climbing schools, where it received very heavy use, justified the confidence placed in it, and at the present time only high price should keep all mountaineers from using it.

Crampons

As with most of the early equipment, the urgency of the need for equipment was so great that standard, well proved designs were relied upon to a great extent. This was especially true of crampons, where very little discussion was needed to decide on the relatively light 10-point ones. Manufacturing them in quantity proved another matter. In order to reduce sizes to a minimum, a high degree of ductility was required in the uprights, while the teeth had to be tempered to be tough but not brittle. We were assured that this combination could be accomplished by proper annealing and heat treatment, but the degree of reliability required was never reached in quantity production. At this point the American Fork and Hoe Company suggested a novel design utilizing bent steel straps ½ inch wide and ⅛ inch thick, secured by rivets set in square holes. The result was a pattern functionally the same as the traditional 10-point crampons, but made from sections which could be given different heat treatments: the uprights were of low carbon steel merely annealed, while the teeth segments were of slightly higher carbon steel, heat treated and drawn to give them necessary toughness and hardness.

Attempts were made later in the war to utilize aluminum, but none of the alloys then available gave a sufficient strength-weight advantage to justify their use. It is possible that some of the new magnesium and other light alloys may prove more satisfactory.

Tents

This proved to be a tough problem all along. Again we did not know where troops would fight, but felt that they should have a tent that would protect them from wind, rain and cold, and still be

light enough to carry. None of the ultra-light cotton fabrics were available in sufficient quantity and the heavier ones were not only too heavy for back packing troops, but did not have the necessary waterproofness. The only means of securing waterproofness and light weight was to use a cotton material lightly coated with synthetic resins. Because of the coating, fabric too porous in itself could be made absolutely wind tight. The resulting tent was modeled after the Meade-type Everest tents, only made a little smaller. Poles were simple A frame poles, which permitted erection easily in high winds, a real advantage.

Had this tent been put up for civilian consumption, the complaints about it would have put the manufacturer out of business. As can be imagined, the waterproof fabric held in and condensed moisture, either as droplets at temperatures above freezing or as frost when below freezing. The resulting annoyance to military occupants was terrific though overemphasized. However it was still a tent giving protection from the elements, light enough to be back packed and easily handled. Experiments with permeable tents showed that they picked up to as much as 100 percent of their dry weight in ice held by the fabric whereas the coated fabric tents added only a fraction of their original weight.

Toward the end of the war real advances were being made in light weight, partially coated fabrics, which may realize the dream of all mountaineers as well as outdoorsmen of a fabric which will let sweat and body moisture out, but keep rain from coming in from the other side. Application of this material to future army light weight tents and clothing should solve one of the greatest single problems of protecting the soldier.

THE EAST FACE OF MT. McKINLEY
From Silverthrone Pass, April, 1945
Photo, Bradford Washburn

A "SNOW-JEEP" ON THE MEDIAL MORAINE OF MULDROW GLACIER
November, 1944

Photo, Bradford Washburn

Personal Equipment

Special Requirements of the Army Air Forces

BRADFORD WASHBURN

DURING the recent war, the fliers of the Army Air Forces constantly performed routine combat and reconnaissance missions which forced them to face the most severe climatic extremes ever encountered by man.

It was not unusual for our fliers, whether based in England or in China, in summer or in winter, to run into arctic conditions less than an hour after takeoff. It became commonplace for aircrews who had breakfasted in Newfoundland or Greenland to eat supper in Italy or Africa.

Never before in military history have articles of personal equipment played so vital a part in actual combat. While the Aircraft and Armament Laboratories at Wright Field equipped our men with the best airplanes and firepower that American ingenuity and resourcefulness could produce, it was the responsibility of the Personal Equipment Laboratory to outfit our aircrews with clothing and a host of other articles that would enable them to operate this equipment with the greatest possible security, efficiency and comfort.

Personal equipment consists basically of flying clothing, parachutes and emergency and survival equipment. All of this materiel was produced to meet the specialized requirements of the Air Forces. It was distributed by the Air Service Command and issued by Air Corps Supply units at bases all over the world. This equipment was considered as supplementary to the regular Quartermaster basic items which were issued to all personnel in the army, regardless of what branch of the service they were in.

The development of AAF personal equipment was kept separate throughout the war because General Arnold and the Air Staff did not wish the unique requirements of their 250,000 fliers to be subordinated in any way to the general requirements of a ground army of several million men. This policy was essentially sound, as it resulted in the development of a large number of remarkable items many of which widely differed in design from regular Quartermaster issue. Unfortunately, however, it also resulted in almost

constant friction between the QMC and the AAF with regard to the responsibility for borderline items, such as footgear, headgear, and camping equipment, used by both air and ground troops. The purpose of this article is to call the reader's attention to a number of the truly special requirements of the AAF which led to the need for a separate research and development agency.

Three things keep you warm on the trail: activity, clothing and shelter. The flier can rely on only one of these. The greatest overall difference between Air Force and Ground Force requirements is in the simple, but frequently unappreciated, fact that the flier does his fighting *sitting* still. The great problem in designing clothing for the Army Ground Forces was in achieving the proper balance between insulation and ventilation—especially in providing simple means for body heat, created by exercise, to be carried away without condensing in the clothing.

A second profound difference in Air Force requirements resulted from the speed with which our fliers passed from one climatic extreme to another. In the China-Burma-India theater our fighter pilots frequently climbed through a range of over 100°F. between ground and combat altitude in a quarter of an hour. Although the use of the zipper was considered inadvisable in most QMC clothing, it was absolutely essential to the AAF in order to achieve adequate, speedy ventilation in flying clothing at ground level, followed by snug, leakproof fit at altitude.

During the winter and spring of 1943 heavy bombardment crews of the 8th Air Force repeatedly faced missions of several hours duration at temperatures considerably colder than –40°F. On several occasions temperatures of between –60° and –70° were encountered. For a while during this crucial stage of the war the frostbite casualties of the 8th Air Force topped all other combined casualties. In the old-type B-24 and B-17 the waist-gunners faced these temperatures opposite open waist-ports through which they operated their guns in a swirling blast of 200 miles of wind. The ball-turret and tail gunners sat almost motionless in their cramped positions for hours on end.

Two different developments caused the rapid decrease of these terrible casualties: the installation of fixed plexiglass "blisters" to cover the open waist-ports, and the improvement of the electric flying suit.

Endless flights and combat experience taught us that if you sit *stock still* for 2 or 3 hours, the only purely insulative clothing that will keep you comfortable at –40° is so bulky that it seriously hampers your duties at your gun, your bombsight or your map. And it was not just *freezing* that we were concerned with. It was found that a man who is too warm and comfortable gets dangerously lax and sloppy aloft in combat—the danger signal in the other direction comes long before you actually begin to freeze your fingers. You cannot freeze the small of your back or your thighs, but you can *think* a great deal about them. Even a little discomfort distracts you. For their safety and efficiency in aerial combat our men had to be able to put 100% of their thoughts on the job. Every possible source of distraction had to be eliminated or minimized.

To give a motionless man adequate protection from a temperature of 60° below zero, it would be necessary to encase him all over in about a foot of insulative clothing. The only alternative to this impossible extreme is to provide auxiliary heat of some sort.

Electrical clothing, except for possible use in vehicles, has to date been considered entirely impractical by the Ground Forces. Although the F-1 electrical suit was far from satisfactory and even the final F-3 model was not perfect by any means, it is fair to state that the high altitude heavy bombing of Europe could not possibly have succeeded if our fliers had been equipped with conventional unheated clothing.

The principle of layering was almost as important in flying clothing as on the ground. We struggled to try to get as much insulation as possible into light flexible garments and at the same time have them versatile. *Versatility* is the most important single feature in the development of all army equipment. A flying jacket which could also be used on the ground saved producing and issuing and storing one extra article. Furthermore, in combat when you are in the air, you never know when you may be shot down with nothing but flying clothing to wear on the ground.

This was one of the main reasons for designing our final models of electric flying suits so that they were a sort of middle-layer garment: these F-3 suits were worn *over* the regular QM clothing which was best adapted to the area *over which* one flew; next came the light electrical suit with its wiring sandwiched between 2 layers of slippery nylon; lastly, the outer layer was an intermediate-

weight flying suit of tough cotton twill with a soft alpaca lining and mouton collar. One rarely took off with all this clothing on at once, unless it was very cold on the ground. Usually the trousers and jacket of the outer intermediate suit were left unzipped until the aircraft had climbed to a considerable altitude. Electrical heat was turned slowly up as the plane climbed, and zippers were closed only when full insulation was finally needed. Pilot and co-pilot frequently needed much less protection than other members of the crew.

The "escape" feature of flying clothing was vital. Until 1945 the only cold weather flying shoe available in large quantities was the familiar, zippered, A-6 fleece-lined boot. It was absolutely impossible to walk on the ground in these shoes for any distance. They were designed to go over officers' dress shoes and not over standard G.I. marching boots. If you wore low shoes and were forced down in combat you were in a serious jam. If you were flying high, the low shoes were not warm enough inside the fleece-lined boots, so our men started wearing several pairs of heavy socks and no shoes at all inside the boots; frequently they wore electric slippers, heavy socks and then the big boot. They still could not walk when they were forced down. In the Arctic we usually used mukluks, which were satisfactory in the air and on the ground alike, but even a mukluk is not satisfactory protection for your feet if you have to sit almost motionless at 40° below zero for several hours. However, over Germany you needed mukluks aloft and G.I. shoes on the ground. Many of our aircrews wore the sock-filled flying boots on their feet, but always carried their G.I. shoes tied to their parachute harness, for use on the ground if they had to bail out. This problem was finally solved by redesigning the fleece boot to go over a G.I. shoe, and by then making a feather-weight electric slipper which went over the shoe but inside the big boot. If you were forced down, you could kick off your clumsy boots and electric slippers and get away in walking footgear adapted to the country over which you were operating.

Gunfire and flak injuries often played terrible havoc with the old F-1 electric suit which was wired in series, like the old-fashioned Christmas-tree lights, with only 2 circuits: a single broken wire, or a lost glove or shoe, and half the suit went out of operation. The final suits in 1945 were wired with 13 *parallel*

THE AAF SHEEPSKIN ARCTIC FLYING SUIT
As it was tested in Alaska in 1942, before being rendered obsolete
Photo, Bradford Washburn

WING COMMANDER WEBB AND THE FIRST MODEL OF THE FAMOUS RCAF TYPE E FLYING SUIT

At 18,000 feet on Mt. McKinley, July 1942

Photo, Bradford Washburn

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circuits. A man could be terribly shot up before the suit really failed him.

The older electric suits were usually used alone with a minimum of clothing worn below and over them. You were helpless if you got shot down in this outfit. If your current failed you aloft, you were congealed with cold in no time. With the F-3 type of suit worn over practical QM clothing and under a light but warm flying suit, you were safe on the ground in any but the most extreme climates. If your current failed, you had enough layers of insulative clothing to get you by for a surprisingly long time before uncontrollable shivering started.

I have dwelt a long time on the electrical suit because it is a perfect example of a vitally important and highly specialized need of the Air Forces. The Canadians were the first to realize that flying clothing should be designed to fit a *seated man* and not an officer at attention—that legs and arms must be curved, that pockets should be placed so as to be useful to all the crew of the aircraft and not just the pilot—that instant removal of flying clothing is critically important after you have parachuted into the water! The United Nations owe a tremendous debt of gratitude to Air Commodore Ryan, Group Captain Hall and Wing Commander Webb, whose practical research for the RCAF called the attention of the world to the real problems of clothing aircrews and laid a foundation for a great part of our progress in other countries.

U. S. Army flying clothing research was carried out with the assistance and advice of the Aero-Medical Laboratory at Wright Field and the experts of the Harvard Fatigue Laboratory. The aircraft experts were constantly designing planes that far surpassed our personnel's capacity to fly them. The Personal Equipment and Aero-Medical Laboratories had to cooperate to try to keep the pilot abreast of his plane.

Clothing development was not by any means restricted to meeting cold-weather requirements. In fact, some of our most serious problems dealt with heat, ventilation, mosquito-proofing of fabric, and the production of waterproof exposure suits for aircrews operating over vast bodies of water.

In these few pages I have not time to discuss the parachute program in detail. The Personal Equipment Laboratory inherited the development of parachutes as well as rescue and survival equipment during a reorganization which took place in the spring of

1944. The difficulties of maintaining production on several different types of personnel and cargo parachutes made of nylon, cotton and rayon, to be used over both land and sea were terrific and unending. These were further complicated with the great increase in the speed and ceiling of aircraft and the extreme difficulties of bailing out at over 35,000 ft. at speeds of 400 and 500 miles per hour.

The production of cargo parachutes was, of course, enormous during the war, and the technique of aerial delivery which was in its infancy in 1941 became one of the important factors in modern military science by 1945. It is interesting to note that a good proportion of our pre-war experience in aerial delivery had been gained on expeditions of various members of the American Alpine Club.

The AAF distributed a huge number of items classified under the general title of Emergency Rescue Equipment. These articles, usually packed in kits, were carried in aircraft all over the world in anticipation of forced landings. Many of these kits were designed to be hitched to your parachute in case of bailout. They often took the versatile form of a back-pad or seat-pad which was snapped to your parachute harness and jammed full of small articles for use when you reached the ground. The fighter pilot operating over large bodies of water actually had an entire one-man life-raft as his seat and a large number of emergency items in his back-pad, both of which followed him overboard if he bailed out. Other kits were strapped next to emergency exits and had small parachutes attached to them so that they could be tossed to unlucky crews in the squadron who might be down in distress. The life rafts, of course, in final models included in the B-29's, were ejected and automatically inflated almost the instant a plane hit the water.

A large number of the items that went into these kits were of QM design. Very few of the kits were ever used exactly as packed and issued, because varying requirements all over the world made it more practical in the local air forces to rearrange the contents to suit their own specific needs.

An interesting example of a specialized and important AAF requirement which one would think overlapped the needs of the ground forces was the need for an Arctic emergency tent. This tent was needed by small AAF rescue parties which had to go to the scene of a crash and evacuate survivors *on the ground.* These tents were to be used in extreme cold, so no waterproofing or

repellency treatment could be used. They had to be double-walled to increase warmth and minimize frosting of the interior. They had to be extremely light for foot trail travel, even though an AAF item. They were expendable and could be thrown away after from one to three weeks use; hence the material could be much lighter than that used in most military tents. Furthermore, combat restrictions as to height and color imposed by the ground forces could be dispensed with, as the Air Forces wanted tents to be particularly *visible* both from the ground and from the air to facilitate locating them at all times. Chrome yellow orange was the prescribed color. This tent was a highly specialized and unique requirement of the AAF, one which in several features was the exact opposite of basic QM rules of design and camouflage.

Sleeping bags, like tents, were a continual source of disagreement between AAF and QM. Not once did the Air Forces compromise on three basic requirements for sleeping bags, requirements which probably should be examined closely by the Quartermaster Corps.

1. AAF sleeping bags must zip across the bottom and up one side, so that wounded personnel can easily be put in and taken out of the bag, and so that wounds are easily accessible at all times without disturbing the patient.
2. For the purpose of ventilation in warmer weather, occasional use as a blanket and general cleanliness, all sleeping bags must be designed so that they can be opened out entirely to form a single flat surface.
3. Sleeping bags for AAF use (where they are rarely carried on the back) need not be quite so restricted as the QMC "mummy-case" bag. The AAF bag must be as simple and light as reasonable, but it is essentially a practical form of bedding rather than an article of featherweight camping equipment. The few ounces of material and cubic inches of space saved by an extreme mummy-case taper may mean much to the infantryman, but are of no consequence in the payload of a B-17 or a B-29. Within reasonable limits U. S. aircrews were to be provided the most comfortable and practical sleeping equipment that available conditions of transport permitted.

No Arctic footgear yet devised by the QM has met AAF requirements. Air Force mechanics and line-crews must *stand*

still for long periods of time on step-ladders, dollys, scaffolds and wings. Even in extreme sub-zero weather their feet are constantly in oil, gasoline and *puddles of water** around the aircraft upon which they have to work outdoors with little or no protection. Although QM dry-tanned mukluks and felt boots are splendid in their special spheres of usefulness, they simply do not fill the bill under these unusual conditions. For this reason the AAF developed a canvas mukluk wth stippled rubber sole (to cling to slippery wings) and waterproof rubber "foxing" running one inch up the sides, so that men could work in grease, oil and water in comparative comfort and safety. This use of rubber, although extremely unconventional, seemed to have no effect whatever on the warmth of our mukluks.

The signaling mirror for emergency use of downed airmen in the wilderness or at sea was a simple but marvelous development that saved hundreds of lives. I would never go into Alaska again on a trip involving air support without one of these wonderful little mirrors.

In the early part of the war, as at the office of the Quartermaster General, the greater part of the development work at Wright Field was done by people *who knew how to live but not to fight* under special conditions all over the world. To keep abreast of constantly changing combat requirements Service Liaison Branches were organized in most of our laboratories, through which a constant flow of information came in from the theaters. The Personal Equipment Laboratory also succeeded in getting a number of men with long combat records brought into the laboratory as full-time advisors or technicians. These men had actually fought with our equipment and knew exactly what was wrong with it and why. We kept two or three representatives in the theaters almost constantly to write and wire reports back to us. Curiously enough, reliable intelligence on our own equipment was always hard to get: The young men were actually doing the fighting, and although they would wax eloquent in their verbal denunciation of this or that, they rarely dared to write their feelings on paper and send them home through channels!

* The hot-air heaters used by the AAF were so powerful that the ice and snow around them always melted into large puddles which could not be avoided by ground crews servicing the planes.

No one knows better the many shortcomings of our equipment than those of us who had to develop it and push it through production. No Army or Air Force in history ever has had or will have perfect equipment. The rapidly changing requirements of modern war simply cannot be met by a steady, satisfactory flow of production.

The Navy, the Army and the Air Forces were all striving separately to meet their own special needs Although extraordinary teamwork was displayed at times, it is still something of a mystery why these efforts could not have been far more closely coordinated. However, one fact is certain: although there is scarcely a man in any branch of our services who does not feel that some of his equipment was far from perfect, you will not find one in ten thousand who would prefer to renounce *all* of his American food and equipment in exchange for that issued by any other of the warring powers. The United States equipped its fighting men better than any other country in the world.

Let us hope that during the months that lie ahead, legislation will be enacted to assure less waste and a higher degree of coordination between our various services, so that specialized needs like those that have just been described can be met more rapidly and less wastefully in the future than they have been in the past.

Mountain Intelligence

H. Adams Carter

THE very first ideas about mountain troops for the U. S. Army sprang from the stories about mountain fighting both in the first and second world wars. When the U. S. Army started its rapid expansion in the fall of 1940, the campaigns of the German Gerbirgsjägers in Norway were still fresh in the minds of the public. The mountaineering world realized that the only effective resistance to them had been made by the French Chasseurs Alpins aided by British and mountain trained Poles near Narvik. Troops specially trained for cold weather fighting had already proved their worth in Finland. Soon the Balkan campaign emphasized the importance of mountain troops. Some people remembered the bitter fighting in the First World War in the Carpathians, the Vosges and the Alps, and others recalled the decisive mountain victory of Caporetto, which nearly knocked Italy out of the war. Few realized, however, that the mountain company which spearheaded the initial attack there was led by an obscure but promising young lieutenant, Erwin Rommel. Few remembered that the Allies lost more men in the battles along the Isonzo than at Verdun or that the Italians, who had only a small number of units trained for mountain warfare, in their first two years of fighting lost over 200,000 men to mountaineering accidents alone. The few who did remember realized that mountain warfare could be extensive and that untrained men stood a poor chance against experts.

Because of the fund of knowledge built up by the armies of the various European countries bordering the Alps, it was obvious that the U. S. Army, completely inexperienced in modern mountain warfare, could best carry out its own training program by studying training methods, practice and equipment of French, German, Swiss and Italian mountain troops. In 1941 there was in the United States an enormous fund of untouched literature on mountain warfare. Unfortunately much of this was not in the hands of the War Department but in public and private libraries throughout the country, so that after the information was collected, it would have to be put into English, a far from simple task. The War Department's normal translators in 1941 knew nothing about mountaineering jargon, and the one or two articles which they had translated

were nearly unintelligible. A piton was a "nail"; a downhill skier was an "off-walking snowshoer." Entire concepts were misunderstood and translated into meaningless words.

In the spring of 1941 the G-3 (Operations and Training) Division of the General Staff of the War Department readily accepted the offer of the American Alpine Club to start me doing intelligence work on mountain warfare. Until February 1942 I spent full time finding and translating articles and books from German, French, Swiss and Italian sources, interviewing former mountain troopers who were living in the U. S., such as Hannes Schneider and Michl Feuersinger, who gave valuable first-hand information, and making digests of some of the most important lessons. After February 1942 I stopped devoting full time to mountain warfare when I was put in charge of Technical Intelligence in the Office of the Quartermaster General.

This transition, however, did not end my work on mountain intelligence, for there were many Quartermaster problems where a knowledge of foreign mountain troops played an enormous part. For instance, an Italian by the name of Bramani had invented a rubber-cleated sole with traction equal to the conventional boot nails of the Alpini. These rubber soles had several advantages: they were lighter and wore longer than steel nails; they were warmer; in a surprise attack they were quieter, and at night did not give off sparks. After discovering their existence, I managed to find a sample pair and worked together with a rubber manufacturer on their development. By the time rubber production in the country was available, the soles were ready to be attached to the ski-mountain boot of the U. S. mountain trooper.

Training in the use of cold weather clothing and equipment was another Quartermaster problem. Here again the knowledge of what other armies did was invaluable. In organizing the initial stages of such training programs I was able to draw heavily not only on my own experience but also on the knowledge of how such matters were handled abroad. U. S. Army circulars, manuals and training films reflected this information.

Meanwhile I was able to assist other sections of the War Department in problems of mountain warfare, providing nearly all of the material on which tactical manuals on mountain warfare and on operations in snow and extreme cold were based. Important articles and manuals were also translated which could not be

entrusted to regular War Department translators, and I wrote the English script for such training movies as the Swiss film on avalanches. Later I was loaned to the Military Intelligence Division of the War Department General Staff to translate and edit their publications of several of the German tactical manuals, such as "Mountain Warfare," "Winter Warfare," "Ski Training and Combat," and also wrote sections and found numerous illustrations for a Military Intelligence book on German Mountain Troops.

My final research on mountain warfare took place immediately after the cessation of hostilities. In Germany in May and June, 1945, I carried out extensive interrogations of members of the German Army and the Waffen SS, much as Major Robert H. Bates had done in Italy. Officers from generals to lieutenants, as well as enlisted and non-commissioned personnel, were carefully questioned about many important points. They revealed, for instance, that the Germans had had enormous difficulties with trench-foot. Their solution to this problem, as with many others, was very similar to what the U. S. Army had worked out. The men had to be carefully trained in how to take care of themselves in temperatures near freezing. Their casualties in this type of weather were far more common than in extreme cold. Training courses were set up in the German Army and weekly refresher courses were given to each man. The Germans found waterproof footgear best for wet cold weather but could supply it only to a few elite units such as the Waffen SS. Even the Quartermaster General of the German Army knew that his troops were taking U. S. Army shoepacs from U. S. dead whenever possible. The Germans recognized that in the mountains trained mountain troops had an enormous advantage, but they also pointed out that in extreme cold and in snow where the terrain was not mountainous, even in trackless swamps, those troops were far superior to ordinary troops because of their great mobility. As a result they were often used on fronts with vastly differing terrain.

My interrogation of Japanese officers in September revealed much less of interest because of their lower degree of specialization. They had made one interesting study, however, because of their enormous shortage of textiles. Cold chamber tests were arranged to find out whether it would be possible to increase insulation on certain portions of the body in order to reduce the overall amount of material. They claimed that if additional layers were worn in a

belt over the collar bones and shoulders and another across the abdomen and the small of the back it would be possible to eliminate some of the weight of the rest of the clothing. This interesting possibility is now being checked by the U. S. Quartermaster Corps.

In the future we can be sure of one thing: the U. S. Army is now interested in mountain problems, and never again will it be as uninformed about mountain fighting or as unprepared for action in all types of rugged and mountainous terrain as it was during World Wars I and II.

An Outline of Alpine Strategy in World War II

J. Monroe Thorington

Map 1. This map shows in diagram form how the Alps form an arc from the Mediterranean, just E. of Nice, to the head of the Adriatic at Trieste. The Ligurian and Etruscan Apennines are represented as a secondary range, extending eastward as a spur from the Maritime Alps, and separating the Po basin from the sea, but breaking down before reaching the Adriatic near Rimini. These two units, taken together, form a mountain circle, complete except for the short break at the head of the Adriatic.

In a general way the passes of the Western Alps connect France and Italy; those of the Central Alps join Switzerland and Italy;

Map 1. The Alpine arc, together with the Apennines, form an almost complete circle. The chief passes of ancient invasion of the Po valley are shown.

while those of the Eastern Alps cross the pre-World War I boundary of Austria.

The routes of invasion in ancient warfare, with few exceptions, led to and not from Italy, the invader crossing the Alps from the outer perimeter with the Po basin as the objective. Thus, the Mont Genèvre Pass was probably Hannibal's route in 218 B.C. from France to Lombardy, although it was traversed in the reverse direction by Caesar in 58 B.C. during his campaign for the conquest of Gaul. Napoleon came southward across the Great St. Bernard on his way to Marengo in 1800. The Brenner Pass was the route by which the northern barbarians swept into the Italian plain in the fifth century.

If our invasion of Italy in World War II, which was unique in coming from the S., had been the *only* second front, we should have been under the unpleasant necessity thereafter—once the Po basin had been reached across the Apennines—of crossing passes of either the Western Alps from Italy to France, or passes of the Eastern Alps from Italy to Austria. Passes of the Central Alps—Great St. Bernard, Simplon and St. Gotthard—could not be used owing to Swiss neutrality, Switzerland itself forming a land-block against direct N.-S. action.[1]

The alternatives of passes through either the Western or the Eastern Alps, with the exception of the Brenner, lead into routes diverging from the direct lines to Germany, and could not have led to rapid military success.

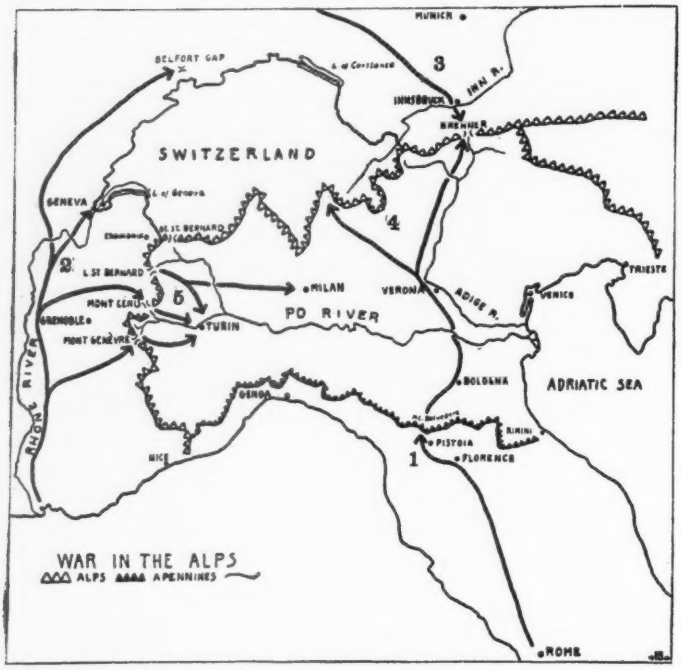
MAP 2. The strategy of World War II in the Alps, therefore, was based on a combination of actions, as follows:

1. Following the taking of Rome, General Clark's 5th Army advanced to the Apennines, while

2. General Patch's command, driving from the Mediterranean through the Rhone Valley to the Swiss border near Geneva, secured the passes of the Western Alps[2] (afterward taken over by the Free French; Lanslebourg, September 18, 1944), and continued N. of the Swiss border through the Belfort Gap of the Jura toward Strasbourg.

3. Following the crossing of the Rhine, at the mouth of the Moselle, General Patton's 3rd Army drove through Bavaria,

[1] "Alpine Invasion Routes from Italy" (*A. A. J.* v, 255).
[2] "The War in the Alps" (*A. A. J.* v, 441).



MAP 2. Showing sequences of action in gaining the Po basin through the Alps and Apennines in World War II.

continuing from Garmisch-Partenkirchen into Austria and the Brenner Pass, linking with

4. General Clark's command which, assisted by the 10th Mountain Division's capture of Mt. Belvedere (February, 1945), later crossed the Apennines and the Po, thence driving to the Swiss border at Como (April 18, 1945) and fanning out to the Brenner Pass (Verona, April 26, 1945). Thus neutral Switzerland advantageously became General Clark's fixed northern flank, splitting enemy forces in Italy. The Ligurian Army surrendered on May 1, 1945.[3] The Apennine action led to the outflanking of the German Gothic line at the Po and allowed

[3] "The War in the Alps" (*A. A. J.* vi, 166).

5. The advance of Free French and Italian partisan forces through the passes of the Western Alps toward Turin and Milan.

Thus the pattern of classical antiquity was repeated, the Italian plain in all instances being attained from outside the Alpine arc. World War II, however, differs from any other in that, at its end, for the first time the Alpine ring itself was entirely encircled by victorious armies.

The Pay-Off on Winter Training

Robert H. Bates

EARLY in the war various members of the American Alpine Club were eager to see the U. S. Army develop considerable numbers of mountain troops and troops trained for cold weather operations. In this way it was hoped that warfare both in mountainous and cold areas, which appeared inevitable, would find our troops with trained men capable not only of fighting the enemy but of fighting them in all sorts of rugged terrain and under severe winter conditions.

For various reasons, among them replacement difficulties, our Army did not go in heavily for special troops. Even though it was well-known that numerous German mountain divisions were in existence and had performed brilliantly in almost all campaigns, U. S. Army policy permitted the formation and training of only one such division, the 10th Mountain, which did not enter combat until January 1945. Some cold weather training, however, was given to a number of divisions, among them the second, the fourth, and the fifth Divisions and the famous First Special Service Force. Some of these units trained in Alaska and Iceland, and others in Continental United States. When these units entered winter combat in Europe, their special training proved of great advantage, but for replacements and for the vast bulk of our combat divisions, cold weather training was never given until after winter combat had begun.

In the winter of 1943-44 the writer was suddenly recalled from a maneuver in the Chulitna area of Central Alaska and sent to Italy with test quantities of cold weather clothing and equipment developed by the Quartermaster General but not as yet supplied to troops in the Mediterranean Theater. The reason for this test was the large number of trenchfoot casualties occurring in the Fifth Army during the campaign through the mountains north and west of Naples. War Department observers had already declared that the issue clothing and equipment was unsuitable for use under the conditions of heavy rainfall, calf-deep mud, slush and wet snow which made life on the Italian front in winter a nightmare of utter misery.

At Anzio, where the test was held, Captain Slauta and I soon found that nearly all troops lacked fundamental physiological knowledge of how best to protect themselves from the miserable effects of cold wet weather. Ignorance of these fundamentals was as much at fault as improper clothing and footwear in causing trenchfoot cases of great severity. Our army in general was wearing clothing better suited to parade ground use in Washington, D. C., than to bitter combat in muddy, snowy, mountainous Italy.

On our arrival a battalion of the 30th Infantry, 3rd Division was immediately outfitted with some twenty-five or thirty new items of clothing and equipment, which they used for a month during patrol actions at Anzio, and continued to use during the breakthrough at Cisterna and the fighting up through the Alban Hills to capture Rome. There was no doubt about it that the new items were good, and as a result of the 3rd Division report suitable winter clothing was requisitioned for all troops in the Mediterranean Theater for their use during the following winter of 1944-45.

The requisitioned items were quickly made by factories in the United States but shipping shortages occasioned by the Anvil Operation (Southern France) caused severe delays in their arrival in Italy, so that shoepacs (barker boots), heavy socks, water repellent field jackets with hoods and other items were not available until the troops were actually in combat in the Gothic Line. Accordingly there was no chance to show men how to use items or even to train supply sergeants in how to issue proper sizes before they were placed in the hands of troops.

Results were bad. Shoepacs were as new to most Southerners as chopsticks—newer perhaps, because at least they had heard of chopsticks. Irate southern colonels declared they would not let their men wear the ** newfangled things, and other unkind words were spoken about sleeping bags, which others uninitiated to their use declared were booby traps. Clearly action was needed because troops were going back to wearing their leather combat boots and more familiar items, and trenchfoot rates were rising. During the previous winter tight-fitting leather boots had helped cause more casualties than enemy action, and we were determined that this should not happen again.

At this point Brig. Gen. Joseph P. Sullivan, the 5th Army Quartermaster, asked Gen. Mark Clark to order all troops to be given instruction in fundamentals of living under wet cold condi-

tions and in the best use of their clothing and equipment. As I had recommended the plan to General Sullivan, I found myself suddenly told to set up a training school and give winter training to the whole 5th Army.

Luckily regiments now were beginning to be relieved and sent for a few days of rest as reserve units to a rest center which had been established at Montecatini. Training here was to continue, however, and I was told that for at least an hour apiece, and more if needed, I could have all troops who came to the rest center.

By great good fortune I was now able to secure the loan of Capt. H. E. Link (later Major), AAC, and Lt. John Clement from the Mountain School, British Mediterranean Forces, where Link was in charge of the American instructors and Clement was on the instructional staff. Both were former members of the 10th Mountain Division and mountaineers of wide civilian experience. Capt. Michael Slauta, who had been attached to me since I had left the United States, made the fourth member of our team. While he went to Montecatini to take over a theater and warehouse and to make other arrangements, Link, Clement and I worked out our curriculum, wrote out instructional material, and had it mimeographed. In no time at all we had moved to the beautiful spa town of Montecatini and the school was in operation.

Our system was to take on a battalion an hour, with Link and Clement haranguing the enlisted men in the Excelsior Theater while I outlined matters in greater detail and at closer range with the officers in the lobby of a spa across the street. Use of all items was demonstrated, and in the theater Sergeant Duke performed an hilarious strip-tease which riveted attention on the stage.

During the next month we averaged 5000 men a day, not counting daily sessions with supply personnel and help in re-equipping troops improperly taken care of earlier. As a result, in a short space of time all troops had received either an hour's instruction or the instructional material which we had had mimeographed.

The men to whom instruction was given would be fighting for their lives in the snowy Apennines during the next few days, followed by months of living in muddy, slushy holes. It was no wonder that they listened well and asked generally intelligent questions. But what we were most interested in were the results. Battle is the pay-off for any army, and as the winter months went

by and despite far more severe weather the trenchfoot rates receded far below what they had been the preceding winter, we felt richly rewarded. Trenchfoot for the Fifth Army in 1944-45, although more troops were involved than the year before and instruction in winter living did not begin until November, totaled less than 20 per cent of the number the year before.

In the future, we are proud to say, all troops in the U. S. Army are to receive winter training of the type given to the 5th Army at Montecatini.

ARMY SERVICE FORCES
Office of the Quartermaster General
Washington 25, D. C.

SPQRD 201
Case, John C.

19 December 1945

Mr. John C. Case
President, American Alpine Club
140 East 46th Street
New York, New York

Dear Mr. Case:

This office wishes to express its appreciation and commendation to you and the personnel of the American Alpine Club for their loyalty, unceasing effort, and many contributions afforded the Quartermaster Corps during the past few years.

Your excellent work and technical assistance in connection with the development of mountain equipment for the soldier are fully recognized and greatly appreciated by the entire Quartermaster Corps. No one realizes more than this office the importance of the time, effort, and skill which have been so fully devoted by your membership in helping this office to improve the mountain equipment for use by troops in the field.

I personally want you to know that the contributions of the American Alpine Club will long be remembered and recognized by the Quartermaster Corps as playing a vital part in the total effort to help bring victory to our country. It is hoped that your organization will continue to be interested in our post-war program of improving existing Quartermaster items and in the development of new ones.

Very truly yours,

GEORGES F. DORIOT,
Brigadier General, QMC
Director, Military Planning Div.

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Material for publication should reach the Editor not later than October 1.

FORM OF BEQUEST

I do hereby give and bequeath to the American Alpine Club, 140 East 46th Street, New York City.....